UNIVERSIDADE CATÓLICA PORTUGUESA

Enterprise Risk Management and Firm Value:

Evidence from the Construction & Engineering Industry

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June 2020

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Master Final Assignment on the category of Internship Report presented to Católica Porto Business School, Universidade Católica Portuguesa for the attainment of the Master degree in Finance

by

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June 2020

Resumo

O principal objetivo deste trabalho é investigar a relação entre a Gestão de Risco Empresarial (GRE), em particular relativamente ao seu nível de implementação, e o valor empresarial. O trabalho foi desenvolvido em contexto organizacional através de um Estágio Curricular com duração de seis meses no departamento de Risco e Compliance do Grupo Mota-Engil, uma empresa de construção portuguesa. Assim, este estudo aborda as implicações de avaliação da GRE em empresas da indústria da Engenharia e Construção. Contribui para a literatura na GRE através do desenvolvimento de uma nova medida para o nível de implementação de GRE, baseada no mais recente programa de GRE desenvolvido pela COSO (Committee of Sponsoring Organizations of the Treadway Commission) em 2017. Segundo o meu conhecimento, é também o primeiro trabalho que investiga a relação entre a GRE e o valor empresarial na indústria da Engenharia e Construção, uma indústria considerada como uma das principais candidatas à adoção da GRE (Durm, 2009). Em termos práticos, o trabalho procura também contribuir para uma maior perceção por parte do Grupo Mota-Engil relativamente à importância da GRE no seu contexto específico, fazendo uma análise orientada para empresas definidas como comparáveis.

Os principais resultados não mostram evidência de uma relação entre a GRE e o valor empresarial. Testes adicionais realizados corroboram os principais resultados, não havendo evidência de uma relação significativa entra a adoção da GRE e o valor empresarial. No entanto, a GRE parece estar associada a um melhor desempenho contabilístico. Estes resultados contrariam a teoria económica, mas são consistentes com outros estudos previamente realizados. Apesar de o estudo da GRE e das suas implicações em termos de valor estar ainda

em uma fase embrionária, esta investigação pode constituir um ponto de partida para o seu estudo na indústria da Engenharia e Construção.

Palavras-chave: Gestão de Risco Empresarial, Valor empresarial, indústria da Engenharia e Construção

Abstract

This main purpose of this work is to investigate whether a relation exists between Enterprise Risk Management (ERM), in particular its level of implementation, and firm value. The work was developed in organizational context through a six-month internship in the Risk and Compliance area of the Portuguese contractor Mota-Engil Group. As so, this study addresses the valuation implications of ERM on companies of the Construction & Engineering industry. It contributes to the ERM literature by studying the value implications of ERM using a new proxy to measure the level of ERM implementation, based on the most recent ERM Framework developed by the Committee of Sponsoring Organizations (COSO, 2017). To my best knowledge, it is also the first work that investigates the relation between ERM and firm value in the Construction & Engineering industry, an industry advocated to be a prime candidate to adopt ERM (Durm, 2009). In practical terms, it is also intended to contribute for the awareness of the Mota-Engil Group about the importance of ERM on its specific context, providing an analysis guided for the defined comparable companies.

The main results provide no evidence of a relation between ERM and firm value. Additional tests corroborate the main results as there is no evidence of a significant effect of the engagement of ERM on firm value. However, ERM seems to be associated with better accounting performance. These results contradict the economic theory, but are consistent with some previous studies. Although the study of ERM and its value implications is still on its infancy, this research can provide a starting point for its study in the Construction & Engineering industry.

Keywords: Enterprise Risk Management, Firm value, Construction & Engineering industry

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List of Abbreviations

ERM – Enterprise Risk Management

TRM – Traditional Risk Management

PRM – Project Risk Management

CRO – Chief Risk Officer

COSO - Committee of Sponsoring Organizations of the Treadway Commission

CAPM - Capital Asset Pricing Mode

SOX - Sarbanes-Oxley Act

S&P – Standard and Poor's

CFO – Chief Financial Officer

RIMS - Risk and Insurance Management Society

Introduction

The literature shows there is no general consensus about a definition for the risk concept. Aven (2012), based in what can be find in the literature, aggregates risk views in five different perspectives: risk as expected value (loss), risk as the combination of probability and extent of its consequences, risk as uncertainty in regard to cost, loss or damage, risk as an event where something of human value is at stake and where the outcome is uncertain and risk as uncertainty about and severity of the consequences (or outcomes) of an activity with respect to something that humans value. As risk is part of a company's day-to-day business, it is important to understand the way it is seen, as it determines the way it will be managed.

Since its very beginning and until the late 1970s, the risk management concept on corporate context suggested mainly buying corporate insurance in order to reduce losses related to insurable risks such as property damage and product liability. With the rise of the Black-Scholes options-pricing model (1973) and the increased fluctuation of the commodities' prices, the derivatives industry grown massively and financial risk started to be managed through hedging activities. Buying corporate insurance as well as the use of derivatives are the most common activities framed in the traditional approach to risk management. Traditional Risk Management (TRM) entails identifying, measuring, monitoring, and perhaps reporting on risks individually or in a "silo" with little formality, structure, or centralization (Lundqvist, 2014) – fragmented view of risk. This means that organizations managed risks by placing responsibilities by business units (silos) and each business unit leader was responsible to manage all the risks related to his area of responsibility (M. Beasley, 2019) . Despite that, the concept

of TRM means essentially to manage risks separately and does not necessary include the activities described above.

This topic has gained increasing attention over the last two decades. Events such as the high-profile financial scandals occurred in the US in the beginning of the 2000's, external pressures demanding increased awareness about risk management, a more complex and interconnected world, and the global financial crisis of 2007 are some examples that drove companies, regulators, investors, rating agencies and academics to address risk management in another perspective. Specifically, more effort was put in developing new risk management frameworks for risk management guidance and a variety of legislation was launched addressing this issue, which led to the emergence to what nowadays is called Enterprise Risk Management (ERM).

The Committee of Sponsoring Organizations of the Treadway Commission (COSO) defines ERM as "a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives". Opposed to TRM, ERM implies firms to manage a variety array of risks in an integrated way (Bertinetti, Cavezzali, & Gardenal, 2013). The economic theory and the literature on ERM argue that, by adopting this integrated approach, firms will mainly introduce benefits for firms. ERM proponents advocate ERM is able to enhance firm value for example by exploiting synergies between risks through information sharing (Prewett & Terry, 2018) or improving insights into different types or risk (Meulbroek, 2002).

Despite the theoretical consensus about the ERM value additive effects on companies, the empirical research is still unable to completely support those arguments. The research on the effects of ERM on firm value is still clearly in its infancy and the results provided by previous investigations are contradictory.

There is some evidence indicating a positive relation between ERM and firm value but also other empirical researches that did not find any influence of an integrated view of risk on companies. One of the main reasons for this lack of clarity and absence of consensus lies in the fact that there is no proxy for measuring the level of ERM implementation on firms. This research gap both in terms of the relation between ERM and firm value and in the absence of a proxy for measuring the level of ERM implementation constitute an open window for this study to contribute for the research field on ERM. The main objective of the research is to answer whether there is a significant relation between the level of ERM implementation and firm value, introducing a new and different proxy for measuring ERM, based on COSO's most recent Framework "Enterprise Risk Management – Integrating with Strategy and Performance" (2017).

This study was conducted in an organizational context through a six-month internship in the Risk and Compliance area at the Mota-Engil Group, one of the biggest construction companies in Europe. As so, the investigation addresses the valuation implications of ERM on companies of the Construction & Engineering industry. The evolution of the risk management concept expanded well-beyond financial firms and contractors were not exception. Because of their business intrinsic characteristics, construction companies have been seen as prime candidates for ERM adoption (Durm, 2009). The traditional approach of risk management on this particular industry was to manage each project in isolation (TRM approach). Consistent with the benefits advocated by the literature, ERM is expected to benefit contractors as it is expected to integrate Project Risk Management (PRM) in the corporate strategy, allowing the risks faced in diverse projects to be managed across all the organization. Despite that, the study of ERM implementation on the construction industry is underexplored. To my best knowledge, no other research has analyzed the effects of Enterprise Risk Management on firm value in this specific context, which constitutes an additional research gap for this study to address.

Overall, the results show no evidence of a significant relation between ERM and firm value, even though additional tests suggest ERM is associated with better accounting performance.

This work is structured as follows. Chapter 1 presents the Literature Review, showing the different visions regarding the risk concept and the reasons behind why it is important for companies to manage risk. The discussion of the evolution of the risk management concept, from Traditional Risk Management to Enterprise Risk Management follows, firstly introducing the traditional risk management approach and its main activities and then the events and external pressures that led to the expansion of the way how risk is seen in corporate context. Subsequently, the concept of Enterprise Risk Management is analyzed, covering its main characteristics as well as the main differences from Traditional Risk Management, the economic theory behind its value implications and the previous research on its relation with firm value. The Literature Review ends with a brief summary about how Enterprise Risk Management is related to the Construction & Engineering industry and with the description of the work developed by COSO on ERM. This is highly relevant in order to understand my approach to measure the level of ERM implementation. Chapter 2 corresponds to the Theoretical Framework and Methodology, where my expectations relative to the research question are revealed and other firm value determinants are discussed. Subsequently, the methodological approach to answer the research question is presented as well as the variables chosen to integrate the model. Chapter 3 corresponds to the Data and Preliminary results, including a proper explanation of the sample development, descriptive statistics and a preliminary analysis to the research question. On Chapter 4, the estimation procedure and main results are presented as well as the robustness check obtained from additional tests, followed by their discussion and conclusion.

Chapter 1

Literature Review

1.1 The concept of risk

There is no agreed definition for the concept of risk. The way risk is understood strongly influences the way it is analyzed, having impact in the decision-making process in companies, especially regarding risk management issues (Aven, 2016). The literature provides evidence that this area struggles with nomenclature – there is a large range of definitions about risk and its related concepts. Some definitions are based on probabilities, chances or expected values, others relate risk exclusively to undesirable or danger events and others appeal to the concept of uncertainty to explain risk (Aven, 2012a). Aven (2012b) aggregates risk views in five different perspectives: risk as expected value (loss), risk as the combination of probability and extent of its consequences, risk as uncertainty in regard to cost, loss or damage, risk as an event where something of human value is at stake and where the outcome is uncertain and risk as uncertainty about and severity of the consequences (or outcomes) of an activity with respect to something that humans value. In general, we can find two main differences in the literature in the way risk is defined: first, while some definitions only consider the probability of occurrence of an event, broad definitions also consider the extent of its consequences; second, while some definitions tend to focus exclusively in the downside effect or potential of risk, broad definitions consider all the possible outcomes. Despite the differences find in the literature, it seems that there are common elements between the various definitions of risk. According to Holton (2004), risk requires both exposure – as a person or a

company care about the outcomes, they will be exposed - and uncertainty about the outcome – e.g., if a man leaps from an airplane without a parachute, he faces no risk because he knows exactly the extent of the consequences of his act (he will surely die). For the ones that include the extent of its consequences in their definition of risk, these consequences must have an impact in terms of utility - positive or negative -, dependent on the perspective (Holton, 2004).

The companies' approach to risk will be determined by the way it is seen: it does not make sense to have another approach rather than avoid it if companies only look for risk as a threat and a way of losing value. On the other side, it does not make sense to avoid risk if the company believes that being exposed to it can be a source of competitive advantage. In addition, companies must not put too much effort in managing or avoiding risks with very low probabilities of occurrence and/or whose consequences do not have material impacts (Aven, 2012b).

The next sections will address the importance of managing risks for companies as well as the development from a traditional view of managing risks to an integrated risk management approach.

1.2 Why do firms manage risk?

According to Merna and Smith (1996), risk management can be defined as "any set of action taken by individuals or corporations in an effort to alter the risk arising from their business". Its main activities typically include diversification and hedging using different instruments, market insurance, self-insurance and self-protection (Dionne, 2013).

When risk was first mentioned, finance scholars saw it as value decreasing at worst and irrelevant at the best case scenario (M. McShane, 2018). Going back to 1958, when Modigliani and Miller (MM) first claimed that, under perfect market conditions (neutral taxes, no capital market frictions (transaction, bankruptcy costs and asset trade restrictions), symmetric access to credit markets where investors can lend and borrow at the same rate and where a firm's financial policy reveals no information), capital structure does not affect firm value and so, because of its uselessness, risk management has no contribution to the value of a firm (Modigliani & Miller, 1958). Another theory that sustained this opinion was the Capital Asset Pricing Model (CAPM). CAPM was developed by Treynor (1961), Sharpe & William (1964), Lintner (1965) and Mossin (1966), based on Markowitz's portfolio theory (1952). This model distinguishes two very important concepts: systematic risk, that corresponds to the risk inherent to all market, is unavoidable and cannot be diversified away; and unsystematic risk, that relates to each stock or firm and is not related with the general market. According to CAPM, investors only care about systematic risk because they can hold well-diversified portfolios that have already eliminated firm-specific risks without any cost or loss of efficiency. This implies that the avoidable risk can be diversified away without resorting to any risk management effort. Despite being two of the most important theories of the finance research, they both rely on a very unrealistic assumption: they both assume the existence of perfect capital markets. Many finance scholars responded to the MM (1958) risk management irrelevance argument, arguing the existence of market imperfections is the reason why risk management can increase firm value (M. K. McShane, Nair, & Rustambekov, 2011). As mentioned by Grace et al. (2010), the market is subject to many imperfections or frictions such as taxes (MM, 1963), bankruptcy costs (Kraus & Litzenberger, 1973), external capital costs (Froot, Scharfstein, & Stein, 1993) and agency costs (Jensen and Meckling, 1976). These frictions exist in the markets firms operate and allow firm-specific risks to impose real costs on firms

(McShane, 2018). This gives an opportunity for risk management to add value within the organization, as it can exploit the market frictions described above. Smith & Stulz (1985) showed that risk management can increase firm value by reducing the probability and the amount of expenses resulting from financial crisis. Froot et al. (1993), Smith & Stulz (1985) and Mayers & Smith (1987) argued that, as risk management reduces companies' cash flow volatility, it allows for a clear interest alignment between shareholders and creditors, reducing the potential for the underinvestment problem, which results from the agency costs between them. Stulz (1996), Leland (1998) and Ross (1998) argued that higher the probability of dealing with erosion costs, higher the value risk management can add by reducing the volatility of the cash flows.

1.3 Corporate Risk Management Theory: from Traditional Risk Management to Enterprise Risk Management

1.3.1 Traditional Risk Management

Although it started to be debated on the 1950s, the concept of risk management is relatively new in the corporate context. As mentioned by George Dionne (2013), several sources relate its origin to the period between 1955 and 1964. During the first years since its appearance, the concept excluded corporate financial risk (only referred to pure risk management) and was exclusively linked with market insurance to protect firms and investors from potential losses associated with property damage, product liability, worker's safety and

compensation and business interruption. Despite that, insurance coverage was costly and incomplete and, as a result, new forms of pure risk management emerged in the mid 1950's and developed during the 1960's: contingent planning activities, self-protection activities and self-insurance instruments. At this time, risk management was mainly viewed as a way to reduce potential losses and ignored potential losses and gains associated with financial risks (McShane, 2018). The 1970's brought a big change in the view of the risk management concept, especially because firms started to incorporate financial risks in their view of risk. During this period, economic agents experienced a major increase in the price fluctuations of commodities and raw materials, but also in exchange rates, stock market returns and interest rates (Dionne, 2013). In order to protect against these financial risks, companies started to use derivatives (before that, derivatives were rarely used and were limited to agricultural products). With the rise of Black-Scholes options-pricing model (1973), which was the first model to price options, the derivatives industry started to develop and grow massively, allowing firms to continuously incorporate hedging activities for financial risks – currency, interest rate, commodity price and credit risks (McShane, 2018). The use of derivatives developed very quickly during the 1980's and companies started to articulate financial risk management with the previous pure risk management activities, even without coordinating them – corporate risk managers were responsible for managing insurable risks and treasury departments to manage financial risks. This period was also marked by the beginning of international risk regulation, namely with the launch of Basel I (1987), which contributed to a higher demand for risk management governance in companies. As a result, the position of Chief Risk Officer (CRO) was created in order to provide effective governance and responsibility over the significant risks. As companies started to have a more integrated view of risk, this period can be argued to have been the starting point for the change of the paradigm in risk management: from a traditional silo approach to risk to a portfolio integrated

view of risk. In the 1990's, corporate risk management expanded well beyond insurance and hedging with derivatives and new forms of risk arose – operational risk, reputational risk, strategic risk, etc. (Nocco et al., 2006). At that time the accounting profession was emerging via internal control and audit (McShane, 2018) and pressures, prompted by highly publicized financial scandals, were being made in the pursuit of a better alignment between risk management and corporate governance. Companies started to remodel their internal control function, incorporating risk management and corporate governance roles for internal auditors (Spira and Page, 2013). The Committee of Sponsoring Organizations (COSO), mainly composed by accounting organizations, released the "COSO Internal Control - Integrated Framework (1992), arguing that the internal control should ensure that companies provide reliable financial reporting and risk assessment should play a central role in the risk management process. More companies were engaged in the creation of the CRO position - this period was clearly marked by the emergence of this function -, which was responsible for the risk management function and was overseen by a board of directors, risk committee or audit committee, responsible for monitoring risk and setting boundaries according to the established risk measures.

The traditional approach to risk management (TRM) entails identifying, measuring, monitoring, and perhaps reporting on risks individually or in a silo with little formality, structure, or centralization (Lundqvist, 2014) – fragmented view of risk. This means that organizations managed risks by placing responsibilities by business units (silos) and each business unit leader was responsible to manage all the risks related to his area of responsibility (Beasley, 2019). Despite that, the concept of TRM means essentially to manage risks separately and does not necessary include the activities described above.

1.3.2 Events, external pressures and the move towards Enterprise Risk Management

The disadvantages of TRM became evident overtime and the evolution towards ERM began in the late 1990's (Bharathy & McShane, 2014). In the mid-1990s a number of publications (Australian/New Zealand Risk Management Standard 4360, Tillinghast-Towers Perrin, and the Conference Board of Canada) began pleading that firm's risk management should include all the risks instead of treating specifically each risk and giving attention exclusively to the ones that were easy to quantify, and that risks should be managed as a portfolio across the enterprise (J. R. S. Fraser & Simkins, 2016). In the 2000's, the risk management topic and the move towards ERM came with another dimension. Specifically, some pressures, mainly pieces of legislation, were launched in response to some events occurred in this period. High-profile financial reporting scandals such as Enron and Arthur Andersen (2001), Tyco International plc and WorldCom (2002), Adelphia (2005), Global Crossing and many others, and the recent financial crisis started in the US in 2007, led to tremendous losses from investors, companies and stakeholders in general, demonstrating the weakness of risk management in many companies at that time. Also, the need of dealing with a progressively complex and interconnected world brought the risk management topic to the forefront and proved that the traditional risk management approach was not enough to address it (Bertinetti et al., 2013). This corporate scandals and business failures cause regulators, rating agencies, companies and academics to put an increased focus on risk management, leading to different ways of thinking on its regard. For this reason, the demand for enhanced corporate governance and risk management appeared. Regulators, auditors and risk assessment agencies launched stringent rules (especially in the US), forcing companies to develop and incorporate more efficient RM systems. More efforts in developing

new Frameworks were made by the mentioned authorities and also by academics. The Sarbanes-Oxley Act (SOX) - "Public Company Accounting Reform and Investor Protection Act" - , established in July 2002, is considered by many to be one of the most important pieces of legislation regarding corporate governance ever made since Securities and Exchange Commission was launched in the 1930s. This law came as a response to some of the financial scandals mentioned above, especially Enron, and included a number of provisions that sought to improve the accuracy of financial reporting and recover confidence in publicly traded companies. It established new standards for corporate accountability, financial reporting and corporate governance in the US. For my purposes, it is important to highlight that companies were forced for the first time to assess financial report risks and develop improved internal control systems to make sure the financial statements were reliable. According to J. Fraser & Simkins (2010), SOX placed greater responsibility on the board to understand and monitor firm risks which increased the importance of risk management. In 2004, the Basel Capital Accord II, which referred to the second set of international banking regulations released by the Basel Committee on Bank Supervision, was launched. As its purpose was to strengthen the capital requirements of banks, one of its main goals was to promote enhanced risk management tactics among larger banks. This accord was sustained in three pillars, from which, for my purposes, I highlight the second pillar: "Supervisory Review Process". This process not only required banks to have adequate capital to support all its risks, but also encouraged them to develop and use better risk management techniques.. In the same year, as firms were demanding better guidance on ERM, COSO released one of the most popular and important ERM Frameworks: "ERM - Integrated Framework", which became a worldwide guideline for risk management. The Framework provided "key principles and concepts, a common language, and clear direction and guidance" (COSO, 2004) on ERM and incorporated their 1992 Internal Control Framework, but with an expanded risk

assessment component (Prewett & Terry, 2018). In December of the same year, the New York Stock Exchange (NYSE) issued a new Corporate Governance (CG) Guide for major public companies, requiring boards to encourage appropriate risk taking and clearly define their risk appetite and audit committees to be more involved in risk oversight (M. K. McShane et al., 2011). Many boards, especially from large and mature companies, started to require the review and approval of risk management by their audit committee, a separate risk committee or a different committee.

Despite the abundance of principles, regulations, Frameworks and standards, the risk management practices at that time completely failed to predict and prevent the global financial crisis started in 2007 in USA. As mentioned by Huber & Scheytt (2013), the potential of risk management to manage risks and prevent crisis had already been questioned by some practitioners and the global crisis gave some credit to their rhetoric. In a joint survey conducted by the CFO Research Services and Towers Perrin (2008) about the causes in the origin of the financial crisis, I highlight that the respondents (the majority of them leaders of ERM processes) argued that poor risk management at financial institutions and poor risk management practices and risk oversight in their own companies (Mikes & Kaplan, 2013) were in the epicenter of the problem. In October 2008, as a response to the financial crisis, the Troubled Asset Relief Program (TARP), with the passage of the Emergency Economic Stabilization Act (EESA), was launched in order to stabilize the financial system in the US. The program stipulated that participating firms must certify that executive compensation programs do not encourage excessive risk taking (M. K. McShane et al., 2011). In May 2009, the Shareholder of Bill Rights Act was proposed, requiring public companies to create independent risk committees composed by independent directors responsible for the establishment, monitoring and evaluation of risk management practices (Bertinetti et al., 2013). In July 2009, the Basel Committee on Banking Supervision, in their "Enhancements to the Basel II Framework"

proposal, provided some supplemental guidance on Basel II's second pillar, addressing risk management issues. This statement highlighted the importance of an improved risk management process after the financial losses occurred from the 2007 crises, as well as the need of developing an integrated firm-wide perspective on risk, overcoming the TRM approaches. Other guidelines such as the definition of risk appetite according to the business complexity and risk capacity, and the attribution of responsibility to supervisors about determining whether a bank has a risk management Framework were launched. According to Pagach & Warr (2011), financial firms have been greatly influenced by the Basel guidelines. Some practitioners didn't accept COSO's Framework (2004) and worked with international standard experts in order to develop the ISO 31000 Risk Management Standard, which was launched in 2009 and is nowadays still internationally accepted and widely used in order to implement ERM (Bharathy & McShane, 2014). The ISO standard outlines a list of attributes of effective risk management, including corporate governance, financial reporting and stakeholder trust (Dorothy Gjerdrum, 2010). Contrary to COSO's 2004 Framework, which was developed by auditors, accountants and financial experts and was a more control and compliance based Framework, ISO was carried out by risk management practitioners and international standard experts. This is particularly important because some argued that COSO's ERM Framework was too much "complex, multilayered and complicated directive" and more difficult for traditional risk managers to embrace (Dorothy Gjerdrum, 2010). In February 2010, SEC established new rules, demanding publicly traded companies' annual statements to include a description of the board's role in risk oversight (Mikes & Kaplan, 2013), in particular regarding the relationship between compensation policies and risk management practices and the board of directors leadership structure (Bertinetti et. al, 2013). Increased awareness about ERM and its implementation is also argued to be related with rating agencies, namely Standard & Poor's (S&P), Moody's and Fitch. S&P was the first to formalize a risk

management component as part of a company's credit rating for financial institutions and insurance companies in 2004. In 2008, S&P announced the intention of adding a risk management analysis as a key factor in the attribution of corporation ratings, creating an index in order to access the risk management process for insurance companies. S&P ended up creating an "ERM rating" aggregating companies according to their level of risk management sophistication determined by factors such as culture, systems, processes and practices with the insurer. The main credit-rating agencies now evaluate how firms manage risks, with Moody's and S&P having an explicit focus on ERM, which takes part of their credit rating valuation in the energy, financial services, and insurance industries (Mikes & Kaplan, 2013). M. K. McShane et al., (2011) and (R. Baxter, Bedard, Hoitash, & Yezegel, 2013) found a positively relation between S&P ERM ratings and firm value and operating performance respectively.

The path of risk management from a traditional risk management approach towards an integrated view of risk has origin in the events described above. This chapter was focused in providing some evidence on the evolution of the concept and the activities it typically involves, having as a start point its origin in the corporate context until nowadays, as well as the pressures and reasons that led companies to deal with risk management in a more comprehensive way instead of looking at it from a fragmented point of view. I did not focus very deeply on what it is, in fact, ERM, but I will address this issue in the next section. However, two important notes must be mention: first, not all firms are engaged in ERM as it is not mandatory. As mentioned by (Bharathy & McShane, 2014), organizations manage risks in a piece-meal fashion and struggle to effectively implement ERM and manage complex strategic risks; second, as we are going to see in the next section, the ERM concept is very straightforward but its implementation it is not. The 2007 financial crises provides some evidence that ERM is still an aspiration

rather than a reality, as many corporations arguing to have implemented ERM failed during this period (McShane, 2018).

1.4 Enterprise Risk Management and firm value

1.4.1 Definition, key characteristics and main differences from Traditional Risk Management

Contrary to the literature on corporate risk management, which is vast, the literature on ERM, also known as integrated risk management, aggregated risk management, strategic risk management and holistic risk management, is still in its infancy (Bharathy & McShane, 2014) – there are already some research and guidelines on ERM as well as on the determinants of the ERM adoption and its effect on the value of a company, but its effective benefits are still questionable. There are no variables that can precisely measure its level of implementation in companies (it is still too subjective) and the reference Frameworks that are most commonly used are standardized and may not give enough insight for some companies to implement it in practical terms.

The earliest evidence of ERM activity was in 1998 (Hoyt & Liebenberg, 2011). Farrell & Gallagher (2015) define Enterprise Risk Management as "the discipline by which enterprises monitor, analyze, and control risks from across the enterprise, with the goal of identifying underlying correlations and thus optimizing the risk-taking behavior in a portfolio context" (please consult tables 1 and 2 for other definitions provided from academics and relevant entities respectively since the emergence of the ERM concept). ERM is an ongoing process incorporated at every level of the organization that means essentially to integrate and holistically manage all the risks faced by it (portfolio view of risk).

Table 1 - ERM definitions and descriptions from academic journals (adapted from Bromiley et al., 2015)

Dickinson (2001)	ERM is a systemic and integrated approach of the management of the total risks a company faces.
D'Arcy and Brogan (2001)	ERM is the process by which organizations in all industries assess, control, exploit, finance and monitor risks from all sources for the purpose of increasing the organization's short and long term value to its stakeholders.
Harrington et al., 2002	ERM is the idea that emerged in the late 1990s that a firm should identify and (when possible) measure all of its risk exposures including operational and competitive risks and manage them within a single unified framework in contrast to the silo approach to risk management.
Meulbroek (2002a)	Integrated risk management is the identification and assessment of the collective risks that affect firm value, and the implementation of a firm-wide strategy to manage those risks.
Barton et al., 2002	Enterprise-wide risk management shifts risk management from a fragmented, ad hoc, narrow approach to an integrated, continuous, and broadly focused approach.
Verbrugge et al. (2003)	ERM is corporate-wide, as opposed to departmentalized, efforts to manage all the firm's risks in fact, its total liability structure in a way that helps management to carry out its goal of maximizing the value of the firm's assets. It amounts to a highly coordinated attempt to use the right-hand side of the balance sheet to support the left-hand side which, as finance theory tells us, is where most of the value is created.
Liebenberg and Hoyt (2003)	Unlike the traditional "silo-based" approach to corporate risk management, ERM enables firms to benefit from an integrated approach to managing risk that

	shifts the focus of the risk management function from primarily defensive to increasingly offensive and strategic. ERM enables firms to manage a wide array of risks in an integrated, holistic fashion.
Kleffner et al., 2003	In contrast to the traditional "silo" based approach to managing risk, the ERM approach requires a company-wide approach to be taken in identifying, assessing, and managing risk.
Miller and Waller (2003)	Integrated risk management is consideration of the full range of uncertain contingencies affecting business performance.
Sobel and Reding (2004)	ERM is a structured and disciplined approach to help management understand and manage uncertainties and encompasses all business risks using an integrated and holistic approach.
(Nocco et al., 2006)	ERM Is a process that identifies, assesses and manages individual risks (e.g., currency risk, interest rate risk, reputational risk, legal risk, etc.) within a coordinated and strategic framework.
Beasley et al. (2008)	ERM is the process of analyzing the portfolio of risks facing the enterprise to ensure that the combined effect of such risks is within an acceptable tolerance.
Farrell and Gallagher (2015)	ERM is the discipline by which enterprises monitor, analyze, and control risks from across the enterprise, with the goal of identifying underlying correlations and thus optimizing the risk-taking behavior in a portfolio context.
Gatzert and Martin (2015)	ERM defines a process that combines the corporate's entire risk management activities in one integrated, holistic framework to achieve a comprehensive corporate perspective.

Table 2 - ERM definitions and descriptions from standards setting organizations, industry publications, industry associations, consulting firms, and rating agencies (adapted from Bromiley et al., 2015)

(AS/NZS 4360 Risk Management Standard, 1995)	Risk management is the culture, processes and structures that are directed towards the effective management of potential opportunities and adverse effects.
Holton (1996)	ERM is about optimizing the process with which risks are taken.
Banham (1999)	Goal of ERM is to identify, analyze, quantify, and compare all of a corporation's exposures stemming from operational, financial, and strategic activities.
Arthur Andersen (Described in Deloach and Temple (2000))	ERM is a structured and disciplined approach that aligns strategy, processes, people, technology and knowledge with the purpose of evaluating and managing the uncertainties the enterprise faces as it creates value… It is a truly holistic, integrated, forward looking and process-oriented approach to managing all key business risks and opportunities – not just financial ones – with the intent of maximizing shareholder value for the enterprise as a whole.
Miccolis (2000)	ERM is a rigorous approach to assessing and addressing the risks from all sources that threaten the achievement of an organization's strategic objectives.
Deragon (2000)	ERM simply seeks to manage interrelationships systemically, in order to minimize variation, reduce inherent risks, and increase positive synergies.
Tillinghast-Towers Perrin (2001)	ERM is generally defined as assessing and addressing risks, from all sources, that represent either material threats to business objectives or opportunities to exploit for competitive advantage.
Institute of Internal Auditors (IIA, 2001)	Enterprise risk management is a rigorous and coordinated approach to assessing and responding to all risks that affect the achievement of an organization's strategic and financial objectives.

Casualty Actuary Society (CAS, 2003a)	ERM is the process by which organizations in all industries assess, control, exploit, finance and monitor risks from all sources for the purpose of increasing the organization's short and long term value to its stakeholders.
Committee of Sponsoring Organizations (COSO) (2004)	ERM is a process, effected by an entity's board of directors, management and other personnel, applied in strategy setting and across the enterprise, designed to identify potential events that may affect the entity, and manage risk to be within its risk appetite, to provide reasonable assurance regarding the achievement of entity objectives.
S&P (2008)	We see ERM as an approach to assure the firm is attending to all risks; a set of expectations among management, shareholders, and the board about which risks the firm will and will not take; a set of methods for avoiding situations that might result in losses that would be outside the firm's tolerance; a method to shift focus from "cost/benefit" to "risk/reward"; a way to help fulfill a fundamental responsibility of a company's board and senior management; a toolkit for trimming excess risks and a system for intelligently selecting which risks need trimming; and a language for communicating the firm's efforts to maintain a manageable risk profile.
ISO 31000 (2010)	Risk management is coordinated activities to direct and control an organization with regard to risk.
Risk and Insurance Management Society (RIMS) (2011)	ERM is a strategic business discipline that supports the achievement of an organization's objectives by addressing the full spectrum of its risks and managing the combined impact of those risks as an interrelated risk portfolio.

Despite disagreements on what exactly constitutes ERM (Bromiley, McShane, Nair, & Rustambekov, 2015), the literature provides consensus on the general view, principles and key concepts about it. First, it only makes sense to go from a traditional risk management approach to an ERM approach if firms believe that it effectively will increase shareholder value through a more optimized risk-return trade off (Farrell & Gallagher, 2015). This is the underlying premise of ERM: every entity exists to provide value for its stakeholders (COSO, 2004). Second, ERM consists in a portfolio-based approach to risk and adds value by gaining "a systematic understanding of the interdependencies and correlations among risk" (M. K. McShane et al., 2011). A major difference from the traditional risk management practices is that ERM aggregates firm's risks from all sources in a portfolio of risks in order to manage and monitor them in an integrated and holistically way. As it argues its main objective is to provide increased value for companies, ERM assumes that managing the risk of a company as a portfolio of risks is more efficient than managing all risks individually and independently (Bromiley et al., 2015). If we apply the concepts under the portfolio theory it should be clear that ERM increases firm value by the simple fact that the risk of an aggregate portfolio should be less than the sum of the individual risks in the case they are not 100% correlated (M. K. McShane et al., 2011). According to Hoyt & Liebenberg (2011), the lack of coordination between departments creates inefficiencies such as unnoticed potential interdependencies between risks when they are managed in separate silos and so, when firms integrate the decision making process across all the classes of risk through the "structure" that ERM provides, they can easily identify such interdependencies as well as avoid the duplication of expenditures related to risk management. Third, ERM practices encourage companies to manage risks and explicitly looking for potential opportunities rather than avoid them. This means that the downside potential of risk plays a very important role when dealing with it, but there is also space for companies to exploit it as a source of competitive advantage. ERM encompasses

an economic capital view where firms must allocate capital in order to achieve an optimizing risk taking behavior. It recons the value that can be added from exposure to certain risks as long as companies have the capabilities for managing those risks. Forth, ERM is supposed to be incorporated in and aligned with business and strategic planning of organizations with an effective risk oversight by boards of directors and senior executives, in a way that strategy and risk mindsets are the same. In TRM, as risks are managed separately in different management functions, a barrier between overall strategy and risk management is created as risks can be overlooked, potential leading to strategic myopia and catastrophic risk management (Beasley and Frigo, 2010). An efficient ERM implementation should ensure that every substantive decision is integrated with risk management (Bromiley et al., 2015), from strategy setting until more operational decisions, guaranteeing a single vision of the company. Fifth, as risks are not static in time, they easily emerge and evolve, which means that it is essential for companies to look for ERM as an ongoing and active process with continuing updates and improvements with constant monitorization of risks and not as process that has a beginning and an end (Beasley, 2019). Table 3 synthetizes the main characteristics of ERM as opposed to TRM based in what can be find in the literature.

Table 3 - Characteristics of TRM vs ERM (adapted from McShane et al. 2018)

Sources	TRM	ERM
Harrington et al. (2002), Power (2005), Ai et al. (2012) and Lundqvist (2014)	View: Silo view of risk. Deals with risks independently. No systematic understanding of Interdependencies and correlation among risks.	View: Portfolio view of risk. Deals with risks holistically. Interdependencies and correlation among risks analyzed and understood. Natural hedges recognized and exploited. Understands internal/ external contexts in evaluating risk portfolio.
Turnbull (1999), McCrae and Balthazor (2000), COSO (2004), Sobel and Reding (2004), Mikes (2005), Stroh (2005), Arena et al. (2010), Beasley and Frigo (2010), Branson (2010). Andersen and Schrøder (2010), Purdy (2011), Ai et al. (2012), Lundqvist (2014, 2015); and Marks (2015)	Limited strategic scope or influence. Technical and tactical not strategic. RM not an important element in decision making by board of directors and top management and not considered important in corporate governance. Middle management function.	Considers the entity's risk appetite/criteria in evaluating strategic alternatives for achieving objectives. Board of directors and CEO are strongly involved with ERM, which plays an important role in corporate governance. Risk management is an essential consideration in strategic decisions.
Stulz (1996), IFAC (1999), Garside and Nakada (2000), Miccolis (2002), Power (2005), Sobel and Reding (2004), Mikes (2005), Nocco and Stulz (2006), Toneguzzo (2010) and Ai et al. (2012)	No consideration for the allocation of capital.	Economic capital view: allocating capital to achieve the highest risk-adjusted return.
Stulz (1996); IFAC (1999); Barton et al. (2002), and Plessis et al. (2015)	Negative, cost-based and narrowly focused on downside only.	Positive, value based, broadly focused. Risk management is not only related to potential downside, but can be used to exploit opportunities to create value.
Power (2004), Nocco and Stulz (2006); and Power (2009)	Ambiguous ownership of some types of risk.	All risks assigned ownership with accountability.
Barton et al. (2002), Harrington et al. (2002), BIS (2003), Mikes (2005), Stroh (2005), Gates (2006), Ai et al. (2012) and Fraser and Simkins (2016), Beasley (2019)	Focus is only on measurable risks, such as hazard and financial risks, while ill-defined operational or strategic risks, such as supply chain, cyber, and reputation risks may be acknowledged but ignored.	Adopts a single, comprehensive risk oversight structure and risk culture for dealing with all types of risk. Especially identifying and prioritizing top/critical risks and understanding root causes.

1.4.2 Economic Theory

Literature on ERM argues that adopting a holistic approach to manage risks will mainly introduce benefits for firms, which will increase their performance and overall add value to them. Academics argue that ERM is able to add value to companies by decreasing earnings and stock price volatility (Hoyt & Liebenberg, 2011), reducing the cost of capital through improved ratings from credit rating agencies (Farrell and Gallagher, 2015), creating and exploiting synergies between different risk management activities through information sharing (Prewett & Terry, 2018), improving insights into different types of risk (Meulbroek, 2002), allowing for a better capital structure decision making (Graham, Rogers, Journal, & Apr, 2007), reducing direct and indirect costs of financial distress as well as bankruptcy costs, creating economies of scale, promoting increased risk awareness witch may favor operational and strategic decisions (Grace et al., 2015), leading to significant cost savings by avoiding the duplication of risk management expenditures (Farrell and Gallagher, 2015) and improving the decision-making process (Florio & Leoni, 2017). ERM also allows for a better understand about the aggregate risk inherent in different business activities, which gives them higher insights for resource allocation and capital efficiency (Farrell and Gallagher, 2015). Besides that, implementing ERM contributes to the reduction of information asymmetries between shareholders and outsiders such as regulators and investors as it allows them to better understand the firm's risk profile (Hoyt & Liebenberg, 2011). On the other hand, ERM may also bring disadvantages such as discouraging risk-taking to excessively low levels (Ellul & Yerramilli, 2013). Furthermore, its implementation is subject to both monetary expenditure and opportunity sacrifice (Farrell and Gallagher, 2015). Overall, the literature supports that ERM programs' benefits

will outweigh its costs, assuring their implementation is value-additive for companies.

1.4.3 Enterprise Risk Management and firm value: previous research and reflections

Despite the arguments used by its proponents, the empirical evidence on the relationship between ERM and firm value is still limited and offers mixed and, to some extent, confusing results. (M. Beasley, Pagach, & Warr, 2008)) find a positive equity market reaction to the ERM implementation for non-financial firms, but not for financial firms. On the opposite side, Hoyt & Liebenberg (2011), studying a sample of US insurance companies, found a positive relation between ERM adoption and firm value as the results indicate that firms that are engaged in ERM are valued 20 percent higher than the others. This results show evidence that ERM adoption brings an ERM premium associated. Gordon, Loeb, & Tseng (2009) find a positive relation between a firm's ERM and its performance but also that this relation is contingent on the proper match between ERM and contextual variables surrounding firms such as environmental uncertainty, industry competition, firm size, firm complexity and monitoring by the board of directors. Pagach & War (2011) find no evidence of changes for various key firm variables in a sample of 106 listed ERM adopters. M. K. McShane et al., (2011) find a positive relation between ERM rating and firm value, but only as firms implemented increasingly sophisticated TRM. As firm's risk management systems are more developed and, once they achieve ERM, there is no significant difference in performance. Baxter et al. (2013), in a sample of US banks and insurance companies during the global crises (2006-2008), find that firms that invest in higher quality ERM systems have higher performance measured both

by accounting returns and market valuation. In contradiction with these results, Anton (2018), studying a sample of Romanian non-financial public firms, finds that ERM creates value during the onset of global financial crisis (2001-2007) but it does not affect firm value in periods of financial turbulences. Bertinetti et al. (2013) find a strong positive impact of ERM adoption on the value of European financial and non-financial firms, regardless the specific industry user. Farrell & Gallagher (2015), with a sample of firms from different countries and industries, found a highly significant valuation premium for the ones with an higher level of ERM maturity. Florio & Leoni (2017) find that Italian non-financial companies with more sophisticated ERM systems are more profitable and better valuated by the financial markets and also that an incomplete adoption of ERM components as no significant impact on firm performance. Agustina & Baroroh, (2016) find that ERM implementation has no significant influence on the financial performance of banking companies listed in Indonesia Stock Exchange as its implementation is merely due to the fulfillment of bank compliance to the existing regulations.

Despite overall it can be argued that the some relevant empirical research indicate a positive relation between ERM implementation and firm value, there is still no universal consensus that can consistently support the arguments of ERM proponents. There is empirical research which found no influence of ERM on company's value, some studies contradict each other's results (e.g. Beasley et al. (2008) and Hoyt and Liebenberg (2011); M. K. McShane et al. (2011) and Farrell & Gallagher (2015); Baxter et al. (2013) and Anton (2018)), some of them study ERM implications in financial firms, which are said to be more advanced in ERM concerns and some just focus on ERM existence instead of its level of extent. Overall, the results regarding the value creation of ERM are inconclusive (Lundqvist, 2014).

There are some reasons contributing for this mixed results: first, the ERM topic is relatively recent as it has only existed for just 15 years; second, as there is no

consensus about what an ERM firm looks like (Lundqvist, 2014), there is not a standard or international accepted proxy for the measurement of ERM implementation. Besides that, as firms are not required to give any disclosure about ERM or publicly announce its adoption, hardly publish comprehensive information about it (Gatzert and Martin, 2015) and tend to disclose minimal details of their risk management programs (Tufano, 1996), it is difficult to identify if they are engaged in ERM and, if so, to what extent. Also, and as a result of the inexistence of consensus about what exactly constitutes ERM, firms tend to have different interpretations about it. For these reasons, developing a reliable variable for its measurement is quite challenging for practitioners ((M. K. McShane et al., 2011); Florio & Leoni ,2017)). According to Anton (2018), the definition of an ERM variable is one of the most important issues in studying the relationship between ERM and firm value.

The literature provides some alternatives on how to measure ERM implementation and extent. Although, the relevant research is relatively limited. If we take a look on the past 20 years, we observe that many relevant publications about the effects of ERM on firm value have used binary proxy variables such as the appointment of a chief risk officer (CRO) or public ERM-related announcement to indicate whether firms have implemented ERM or not. Beasley, Pagach, & Warr (2008) and Pagach & War (2011) considered the hiring announcement of a CRO as a signal of adoption of an ERM process. Despite the authors consider there are reasons to believe the CRO hiring coincides with the adoption of an ERM program (see Pagach & War, 2011 and Beasley et al., 2005), the literature raises some doubts about it. According to Grace et al. (2013), this method may lead to biased results as there can be the case where the existence of a CRO does not correspond to an implemented ERM program or the title of the job of the person responsible for overseeing the process is different. Hoyt & Liebenberg (2011), Eckles, Hoyt, & Miller (2014) and Anton (2018), using different search engines (Factiva, Thompson and others), have performed a detailed

search of ERM evidence on financial reports, newswires and other media related to US insurers. The method to determine if an insurer was engaged in ERM consisted essentially in searching for the following phrases, their acronyms and individual words within the same paragraph: "enterprise risk management," "chief risk officer," "risk committee," "strategic risk management," "consolidated risk management," "holistic risk management," and "integrated risk management." Then, all the "hits" were reviewed within their context and in reverse in order to find the earliest evidence of ERM activity. Bertinetti et al. (2013) followed a similar approach by collecting by hand all the financial reports of 200 European companies and performing a detailed search for ERM evidence (explicit or implicit). Agustina & Baroroh (2016) followed the same approach. There is some criticism that can be appointed to the methods described above: first, they rely on very simplistic variables to represent the implementation of a complex program as ERM (Mikes & Kaplan, 2013); second, they allow for no differentiation between the levels of ERM implementation (Gatzert & Martin, 2015); third, self-reporting is subject to obvious bias (Bertrand and Mullainathan, 2001). In the search for ERM sophistication measures, further studies use external databases, namely risk management ratings and ERM maturity assessment scores. M. K. McShane et al. (2011) and Baxter et al. (2013) use S&P risk management rating (from April 2008) as a proxy for the degree to which an insurer has implemented a risk management program. The rating considers issues such as risk management culture, risk control processes, emerging risks management, risk and economic capital models, and strategic risk management and places each insurer into one of five categories – weak, adequate, adequate with a positive trend, strong and excellent. For statistical analysis, the authors translated categories into numerical scores from 1 (weak) to 5 (excellent). The major issue here is that studies that rely on S&P ERM ratings must assume that the rating agency's assessment, which is based on public information, is a good indicator of the actual risk management processes that are implemented on firms

(Mikes & Kaplan, 2013). Farrell & Gallagher (2015) analyze the valuation implications of ERM using an ERM maturity assessment score from Risk and Insurance Management Society (RIMS), which ranks ERM maturity of enterprises from different business activities. The index is created via an online survey assessment for companies' executives in risk management. It comprises various risk management frameworks such as COSO (2004), ISO 31000 (2009) and others and a total of seven attributes that describe the main characteristics of an ERM program. The respondents are asked to rate each of the characteristics considering the effectiveness of the activities, the degree of proactivity and the coverage through the organization from 1 to 10. With the answers, RIMS produces a maturity scale from 1 to 5 for each of the seven components as well as an overall ERM maturity score. According to the authors, RIMS index is a more reliable source compared to S&P ERM ratings, which are based in its analysts perceptions and standards and only includes a limited number of subfactors. Despite it can lead to some source of bias, the RIMS index is completed by "high-level employee with a thorough and strategic oversight of the risk management activities of the organization". Baxter et al. (2013) consider that, although surveys to company personnel provide valuable insides of the firm, they are susceptible to be biased and that constitutes a key limitation, especially when the subject of the study is the quality of the program. Other authors developed their own index to measure the firm's level of ERM implementation. For example, Gordon et al. (2009) developed an ERM index (ERMI) based on COSO's 2004 defined four objectives of ERM: strategy, operations, reporting and compliance. Two indicators were used for each objective and the ERMI was the result of the sum of the eight indicators. Florio & Leoni (2017) considered six binary variables – 3 representing risk management integration into corporate governance and 3 representing the characteristics of the risk assessment procedure – representing the components suggested by the Italian Corporate Governance code and described by the previous international literature as components of an efficient

ERM system. The score for ERM sophistication corresponded to the sum of all the 6 components. Then, they differentiate between ERM sophistication system and rudimentary ERM systems, creating a dummy variable that took the value of 1 if the score was at least 4, representing ERM sophistication, and 0 otherwise. With this methodology they were able to differentiate between sophisticated and rudimentary ERM systems but not between higher levels of ERM implementation.

Table 4 synthetizes the results obtained on previous research on the relation between ERM and firm value as well as the methodology for ERM measurement.

Table 4 - Previous research on the relation between ERM and firm value

Objective	Author	Sample	Dependent Variable	Independent Variable	Method	Controls	Results
Examine the equity market reactions to announcements of appointments of senior executive officers overseeing the enterprise's risk management processes	**Beasley et al. (2008)**	120 firms announcing the appointment of a senior executive overseeing the ERM processes from 1992-2003	Equity market reaction	CRO announcement	Research of the words "announced", "named", or "appointed" in conjunction with position descriptions as "chief risk officer" or "director of risk management" in the business library of LEXIS-NEXIS	Growth options, intangible assets, cash ratio, earnings volatility, size, beta	On average, there is no aggregate significant market reaction to the hiring of CROs for financial service or nonfinancial service firms
Investigate whether the relation between ERM and firm performance is contingent upon the proper match between ERM and five key contingency variables	**Gordon et al. (2009)**	112 US firms that disclose the implementation of their ERM activities	Firm performance (One-year excess stock market return)	ERM effectiveness	Development of an index based on COSO"s (2004) four objectives of ERM. Two indicators were defined for measuring each objective. The score equals the sum of the eight defined metrics.	Environmental uncertainty, industry competition, firm complexity, firm size, monitoring by board of directors	The ERM - firm performance relation is contingent on the proper match between ERM and environmental uncertainty, industry competition, firm size, firm complexity and monitoring by the board of directors

Study the effect of adoption of ERM principles on firm's long-term performance	**Pagach & War (2011)**	106 public traded companies that announced a Chief Risk Officer between 1992 and 2004	Leverage, financial slack, size, opacity, R&D, market-to-book value, return on equity	ERM adoption	Research of the words "announced", "named", or "appointed" in conjunction with position descriptions as "chief risk officer" or "director of risk management" in the business library of LEXIS-NEXIS		There is no evidence of any significant changes in various key firm variables for ERM adopters
Measure the extent to which specific firms have implemented ERM programs and assess the value implications of those programs	**Hoyt and Liebenberg (2011)**	275 public traded US insurers that operated in any year during 1995 and 2005	Firm value (Tobin's Q)	ERM implementation	Research of ERM related key terms and their acronyms in the Annual Reports	Size, leverage, sales growth, return on assets, industry diversification, international diversification, dividends, insiders, life	On average, insurers with ERM programs are valued approximately 4 percent higher than other insurers.
Investigate the relationship between ERM and firm performance	**McShane et al. (2011)**	82 publicly traded insurers for which S&P released an ERM rating on April 2008	Firm value (Tobin's Q)	ERM rating	Access to S&P ERM ratings	Size, leverage, systematic risk, cash flows volatility, return on assets, growth opportunities, complexity	Firm value increases as firms implement increasingly more sophisticated TRM but does not increase further as firms achieve ERM
Investigate the impact of the adoption of an ERM system on the enterprise value and discover which are the determinants of its adoption	**Bertinetti et al. (2013)**	200 European listed companies on STOXX Europe Large 200 Index from 17 different industries	Firm value (Tobin's Q)	ERM adoption	Detailed hand research for ERM evidence on Financial Reports	Size, leverage, return on assets, sales growth, dividends, beta, opacity, financial slack, annual variation of EBIT, annual change of company value	Overall, ERM increases firm value regardless the specific industry user
Investigate company characteristics associated with variation in ERM quality and the association of ERM quality with performance and market response	**Baxter et al. (2013)**	165 firm-year observations of US banks and insurance companies with coverage in the S&P Ratings Direct Database during the period between 2006-2008	Accounting performance (ROA) and market response (Tobin's Q)	ERM quality	Access to S&P ERM ratings	Board size, Board independence, firm size, number of segments, operating profitability, institutional ownership, leverage, growth opportunities, capital-over-sales, credit rating, return on assets	Companies that invest in higher quality ERM have higher performance as measured both by accounting returns and market valuation

Analyze the valuation implications of ERM maturity	**Farrell and Gallagher (2015)**	225 publicly listed firms from various sectors that have completed the RIMS ERM Maturity Model over the 2006-2011 period	Firm value (Natural logarithm of Tobin's Q)	ERM maturity	Access to RIMS online survey model assessment results	Size, financial leverage, return on equity, sales growth, systematic risk (beta), industrial diversification, international diversification, insider share ownership (and its squared value), dividend payment status	There is a significant valuation premium attached to enhanced ERM maturity
Analyze the influence of ERM upon the firm value	**Agustina and Baroroh (2016)**	30 banking companies listed in Indonesia Stock Exchange from 2011 until 2013	Firm value (Price-to-book value) and Financial performance (Return-on-Equity)	ERM level of implementation	Research on companies' Annual Reports for the fulfillment of the Guidelines of risk management stipulated in Bank Indonesia Regulation		ERM implementation has no significant influence in neither company value and financial performance
Investigate the relationship and its extent between ERM systems and firm performance	**Florio & Leoni (2017)**	Non-financial companies listed on the Milan Stock Exchange between 2011 and 2013	Firm performance (ROA as accounting performance measure and as capital market performance measure)	ERM sophistication	Development of a comprehensive ERM score as the sum of 6 binary variables, 3 representing RM integration into CG and 3 representing the risk assessment procedure	Number of board directors, percentage of independent directors, size, industry, leverage, return on equity	Sophisticated ERM systems are both more profitable and better valuated by financial markets. Companies with rudimentary ERM systems are less profitable and less appreciated by investors
Investigate the effects of ERM implementation on the firm value in different economic environments	**Anton (2018)**	Romanian listed non-financial firms for the periods between 2001-2007 and 2001-2011	Firm value (Natural logarithm of Tobin's Q)	ERM implementation	Search of ERM related key terms and their acronyms in the Annual Reports	Size, leverage, ability to access financial market, liquidity, profitability, investment opportunities	ERM creates value in the period between 2001-2007. Over periods of economic and financial turbulences, ERM does not affect firm value in any significant manner

1.5 Enterprise Risk Management in the Construction & Engineering Industry

The Construction & Engineering industry is typically characterized by a restrict number of large projects per year. As so, contractors are highly dependent on this construction projects to generate revenues and profits and ensure a sustainable growth. Due to their intrinsic nature, their use of many players and their high dependency on local, natural and human environments and resources (Liu, Zou, & Gong, 2013), construction businesses are usually associated with complex and diverse risks (Mhetre et al., 2016):

1) strategic risks, associated to the design, specification, investigation, changes in scope, construction procedures and resources availability;

2) operational risks, general related to issues regarding with labor productivity and disputes, design adjustments, quality of equipment and the use of new technologies;

3) organizational risks, influenced by contractual relations, contractor's and workforce experience and communication between the parties;

4) financial risks, due to changes in exchange rates, which are particularly important for companies operating in diverse geographic areas, market demand, payment delays and taxes;

5) socio and political risks, highly dependent on the geographic area of intervention, can include changes in laws and regulations, cultural barriers, bribery and corruption, civil disorder and threats conditioning the workforce, pollution and safety rules and the extent of requirements for permits and respective approval and

6) environmental and safety risks, which include all the risks related to natural disasters and weather conditions and their implications in structure and equipment damages, and work accidents, labor injuries and wealth.

Because of these risks, a great emphasis is given to project risk management (PRM) both by the industry and academics (Zhao, Hwang, & Low, 2013). PRM is the process that accompanies the construction of a project during its life cycle, from its definition, through its planning, execution and control phases up to its completion and closure. Similarly to risk management, the traditional approach to project risk management considers the projects as being independent of each other (Laslo & Goldberg, 2008) – silo-based approach. Large construction companies usually have to deal with a multi-project environment in which diverse construction projects need to be planned, submitted and executed at the same time. For that reason, managers need to define priorities as different projects are simultaneously competing for resource allocation. According to Adibi (2007) and Zhao et al. (2011;2012), excessive attention exclusively given to PRM, results in a lack of holistic view and transparency across multiple projects, inefficient resource allocation and difficulties in achieving strategic objectives. This may be caused not only by deficiencies at the project risk management level, but also due to inefficient ERM (Liu et al., 2013).

The previously discussed external pressures, financial corporate scandals and reasons advocating for ERM implementation were not limited to financial companies and gain significant repercussions in all industries. This paradigm shift in the way companies view risk management was also embraced by the construction industry. In addition, the increasing complexity of technology as well as the scale of construction projects and high market competition, make it misfit for companies to allocate project risk in a single project team (Liu et al., 2013). For these reasons, construction firms have been seen as prime candidates for ERM adoption (Durm, 2009). In 2010, Deloitte predicted growth and prevalence for ERM in the construction industry. In this concrete context, ERM is expected to provide new ways to improve PRM, managing the risks faced by the various projects and incorporating them in a corporate strategy (Adibi, 2007). In other words, in the construction industry ERM and PRM are intertwined with

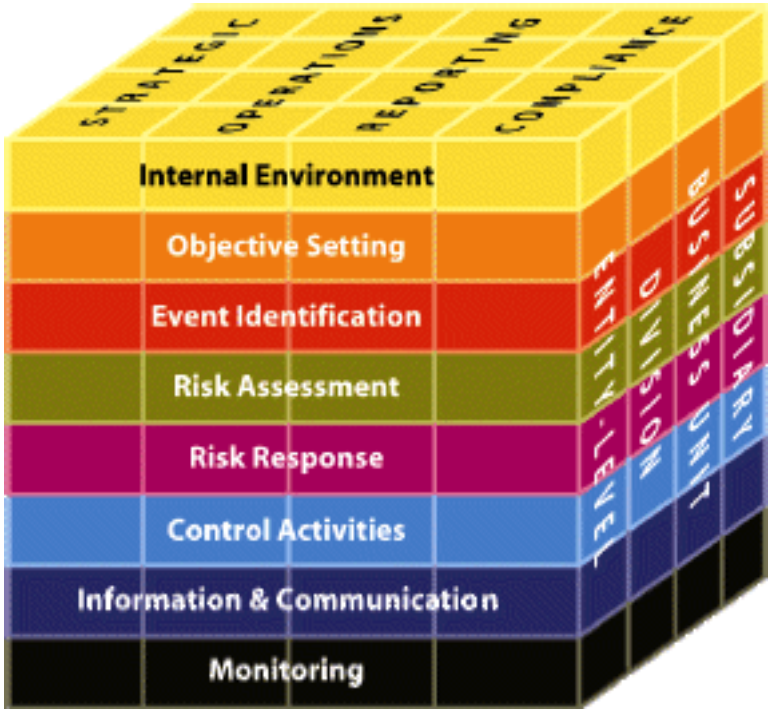
each other as PRM can be seen as an integral part of the ERM (Zhao, Hwang, & Low, 2014). ERM cannot be implemented without PRM as they are both risk management practices, but at different levels of the organization. Liu et al. (2013) found evidence that ERM can positively influence the implementation of PRM. Although, according to the same authors, the literature shows that PRM has involved ERM very little in the construction industry. Despite the emphasis of the literature on the importance of ERM on the construction industry, the study of ERM implementation in this context in still an under explored issue. To my best knowledge, there are no previously researches directly studying the relation between the level of ERM implementation and firm value, which gives a good opportunity for this work to contribute for the ERM research and, at the same time explore it in an under explored context. The majority of the researches that investigate ERM in the Construction & Engineering industry are focused on Chinese Construction firms. Also, contrary to other industries, in which some models were developed to assess ERM maturity (e.g. S&P, RIMS and AON), there is only one proposal for ERM maturity assessment (to my best knowledge) developed by Zhao et al. (2013). The problem for the application of this assessment in the context of this work is that it was designed for firms to evaluate their own ERM maturity based on their knowledge about the company. Also, it was specifically designed for Chinese Construction firms. In an additional note, it is important to highlight that a large percentage of the components utilized in the referred ERM maturity model are very similar to those described by COSO as components of an ERM system.

1.6 COSO on Enterprise Risk Management

The Committee of Sponsoring Organizations of the Treadway Commission (COSO) was established in 1985 and is a joint initiative of five private organizations – American Accounting Association, American Institute of Certified Public Accountants, Financial Executives International, The Association of Accountants and Financial Professionals in Business and The Institute of Internal Auditors – which provides leadership and guidelines on enterprise risk management, internal control and fraud deterrence through the development of frameworks. Its first publication was the 1992 "Internal Control – Integrated Framework". Specifically regarding ERM, COSO has released two Frameworks, the first one named as "Enterprise Risk Management – Integrated Framework" (Commission, 2004). The Framework was launched following many corporate scandals and highly influenced by the Sarbanes-Oxley Act (2002) as in the beginning of the 2000's companies were demanding for better practices and guidance on risk management and corporate governance. Since then it has become a widely-internationally accepted Framework for firms across all industries and nowadays is still used as a reference Framework for ERM implementation. The Framework is similar in structure and tone to the 1992 Internal Control Framework but largely expanded in the risk assessment component (Prewett & Terry, 2018). It clearly highlights the importance of the involvement of the leaders of the organization in the process as well as the way ERM should be related to the entity's strategy. Its guidelines are based on the principle that ERM is geared to achieve the entity's objectives, which can be set in four categories - strategic, operations, reporting and compliance – and should be managed within the entity's risk appetite. The framework also defines and describes a set of eight interrelated components that should be part of the ERM system in the pursuant of those objectives. These are the internal environment,

objective setting, event identification, risk assessment, risk response, control activities, information and communication and monitoring (COSO, 2004). Figure 1 shows the ERM model, which is illustrated on COSO's Framework. COSO designed the ERM model in a cube on purpose in order to illustrate the links between the objectives (on top), the eight components of the system (on front) and the organization's units (on the right side).

Figure 1 - The ERM model in COSO (2004)



In June of 2017, COSO, together with PwC, released an updated and more complex version of the 2004 Framework, named "Enterprise Risk Management – Integrating with Strategy and Performance". In the Executive Summary of the 2017 Framework, COSO stated that "the Framework (2004) has been used successfully around the world, across industries, and in organizations of all types and sizes to identify risks within a defined risk appetite, and support the achievement of objectives. Yet, while many have applied the Framework in practice, it has the potential to be used with more depth and clarity, and by providing greater insight into the links between strategy, risk and performance".

(COSO, 2017). The main purpose of this Framework was to reinforce the emphasis on the importance of integrating risk related issues in the strategy setting in order to fulfill organization's performance objectives as well as deeper recognition of the role of corporate governance and culture in risk management. Also, it was developed in order to reflect evolution in technology and increased perception on the role of risk management in all types of organizations (Prewett & Terry, 2018). Figure 2 shows the ERM model in the 2017 Framework which, by itself, highlights some differences when compared to the 2004 model. There are five terms positioned between the intersect ribbons and five terms beneath the ribbons – governance and culture, strategy and objective-setting, performance, review and revision and information, communication and reporting -, which represent the components of the model. Then, each component is represented in the ribbons by its respective color, meaning that all the components are interrelated and integrated across all the process that leads to value enhancement – mission, vision and core, strategy development, business objective formulation and implementation and performance. A set of 20 principles is attached to each one of the five components, covering all the aspects from governance to monitoring. Figure 3 highlights the title of the principles (please consult the appendix to see their respective descriptions) as well as the components where they belong. Concepts used to describe 17 of the 20 principles were previously addressed in the 2004 Framework, although with much less detail (Prewett & Terry, 2018). The main upgrade of this Framework compared to the one released in 2004, besides the way components are organized and communicated and the depth of analysis of the key concepts and principles, is the emphasis on the components of governance and culture and strategy and objective-setting.

Figure 2 - The ERM model in COSO (2017)

Figure 3 - COSO 2017 ERM components and principles

Governance & Culture

1. Exercises Board Risk Oversight
2. Establishes Operating Structures
3. Defines Desired Culture
4. Demonstrates Commitment to Core Values
5. Attracts, Develops, and Retains Capable Individuals

Strategy & Objective-Setting

6. Analyzes Business Context
7. Defines Risk Appetite
8. Evaluates Alternative Strategies
9. Formulates Business Objectives

Performance

10. Identifies Risk
11. Assesses Severity of Risk
12. Prioritizes Risks
13. Implements Risk Responses
14. Develops Portfolio View

Review & Revision

15. Assesses Substantial Change
16. Reviews Risk and Performance
17. Pursues Improvement in Enterprise Risk Management

Information, Communication, & Reporting

18. Leverages Information and Technology
19. Communicates Risk Information
20. Reports on Risk, Culture, and Performance

Chapter 2

Theoretical Framework and Methodology

2.1 Theoretical Background

The main purpose of this study is to evaluate the impact of the level of ERM implementation on firm value. The economic theory and the arguments used by ERM proponents suggest that ERM benefits more than outweigh its costs or disadvantages. Based on the arguments presented above, it is expected that both the engagement on ERM – the change from a more traditional vision of risk management to the adoption of a comprehensive risk management system - and its level of implementation – the quality of the ERM system - are positively associated and value additive for firms. However, the results presented by previous studies on this topic are not completely in line with the arguments presented on the literature. Both in terms of the effects of ERM engagement and level of implementation on firm value, the literature offers contradictory results. To my best knowledge, there is no evidence of negative effects of ERM on firm value but its relevance is still questionable. Despite that, there is more evidence that ERM benefits firm value than that its effect is irrelevant (Hoyt and Liebenberg, 2011, McShane et al., 2011, Baxter et al., 2013, Bertinetti et al., 2013, Farrell and Gallagher, 2015, Florio & Leoni, 2017 and Anton, 2018). Also, it can be argued that the absence of general consensus can be due to the lack of accurate and standard measures for ERM. To my best knowledge, no other study has been developed in order to study the relation between ERM and firm value in the Construction & Engineering industry. The literature highlights the importance that ERM implementation can have on PRM. Besides that, the ERM theory and

practice do not make distinction of particular characteristics of effects ERM may have depending on the industry. The most well-known ERM Frameworks were designed for application "for different organizations, regardless of size, type or sector (COSO, 2017). Taking this information together with economic theory about the value enhancement benefits of ERM, I expect a positive and significant relation between the level of ERM implementation and firm value. However it would not be surprising if the results reported no significance about its effect.

The relationship between ERM and firm value must be investigated after controlling for those variables that were argued to impact firm value in previous risk management researches. Colquitt, Hoyt, & Lee (1999), Liebenberg & Hoyt (2003), M. S. Beasley, Clune, & Hermanson (2005) found evidence that larger firms are more likely to implement ERM programs. On the other side, size may affect the scope of risks for larger firms as well as constrain the amount of resources to allocate into ERM systems (Florio & Leoni, 2017). Lang & Stulz (1994), Allayannis and Weston (2001) and Bertinetti et al. (2013) found a negative and significant relation between size and firm value. Florio & Leoni (2017) provided evidence that bigger companies tend to report higher operating performance but have lower market values. The relation between size and firm value is expected to be negative. If we focus on the theories about capital structure, the predicted sign for the relation between capital structure and firm value is ambiguous. On the one hand, leverage enhances firm value because it creates tax shields (Modigliani & Miller, 1963) and as it reduces free cash flows, it implies a higher level of discipline from managers, who will not be tempted to invest in sub-optimal projects (Jensen, 1986). On the other hand, excessive leverage can increase the probability of default and distress costs (N. D. Baxter (1967), Warner (1977), Altman (1984) e Myers (1993)). M. K. McShane et al. (2011), Bertinetti et al. (2013) and Farrell and Gallagher (2015) found a negative and significant impact of leverage on firm value. Titman & Wessels (1988) reported that firms with growth opportunities tend to have high market and book value

ratios. Consistent with previous ERM studies' expectations, I expect a positive relation between growth opportunities and firm value. Allyanis & Weston (2001) highlighted that more profitable firms are more likely to trade at premium and are higher valued then identical less profitable firms. M. K. McShane et al. (2011), Baxter et al. (2013) and Bertinetti et al. (2013) found a strong and positive effect of profitability on firm value. I expect profitability to be positively related to firm value. Industrial diversification is associated both with costs and benefits for firms. It can create benefits such as scope economies, larger internal capital markets and reduce risk (Lewellen, 1971 and Teece, 1980) but at the same time it may escalate agency costs and lead to inefficient cross-subsidization of low performing businesses (Easterbrook, 1984 and Va & Ofekb, 1995). As the majority of the firms in the sample, which will be discussed below, are industrial diversified, it is important to control for this factor. Other corporate governance determinants, namely related with the board of directors, are described in the literature as having an impact on firm value. Yermack (1996) presented evidence that small boards of directors are more effective in the way they provide higher firm values and favorable financial ratios. Baxter et al. (2013) found a negative influence of board size on financial performance as measured by return on assets (ROA) but no significative effect on firm value as measured by Tobin's Q. I expect an inverse relation between the number of board directors and firm value. Rosenstein and Wyatt (1990) found that more outside directors increase firm value as markets can perceive it as a merger or new investment opportunity. The percentage of outside directors composing the board is expected to be positively related to firm performance.

2.2 Variables and Models

In order to evaluate the effect of the level of ERM implementation on firm value, I have used Tobin's Q (*TobQ*) as my explained variable and *ERMscore* as my explanatory variable of interest. The use of Tobin's Q as a proxy for firm value is consistent with the general practice in corporate finance (Hoyt and Liebenberg, 2011) and is supported by Smith and Simkins (2005), who reported that the majority of the studies use Tobin's Q to proxy for firm value. Additionally, it has been used recently in different studies of the ERM value implications performed by Hoyt and Liebenberg (2011), McShane et al. (2011), Baxter et al. (2013), Bertinetti et al. (2013), Farrell and Gallagher (2015), Florio & Leoni (2017) and Anton (2018). Tobin's Q ratio compares the market value of a firm's assets to their replacement cost, which means that higher the value of the ratio, better the judgment of market about a company. According to Lang and Stulz (1994), Tobin's Q dominates other performance measures: it is preferable than accounting measures as it reflects market expectations, which means it is relatively free from managerial manipulation of the accounting information; and, contrary to stock returns measures, doesn't require risk adjustment or normalization.

In the attempt of measuring firm's level of ERM implementation, I have created a comprehensive ERM score based on COSO's "Enterprise Risk Management – Integrating with Strategy and Performance" Executive Summary (2017), which, as described previously, defines a set of 20 principles that companies should embrace in order to guarantee the link between strategy, performance and risk in a way that allows them to guarantee reasonable expectation that risk management is clearly aligned with their interests and business objectives. In the COSO's 2017 Executive Summary all the principles are followed by a corresponding description. As so, in order to measure the level of

ERM implementation, I have performed a detailed analysis of companies' Consolidated Annual Reports, Corporate Governance Reports and websites, with an increased focus on the Risk Management Sections, looking for information (explicit or implicit) that matched each principle's description. For each principle a score of 0 or 1 was attributed depending on the information disclosed by the company: when the disclosure provided information in accordance with the principle's description, a score of 1 was attributed; when there was no information regarding a principle in the risk management section or other relevant section for that principle, or when there was evidence of contradiction of the principle, a score of 0 was attributed. The *ERMscore* variable corresponds to the sum of the values (0 or 1) of all the principles described on COSO's Framework (2017) and ranges from 0 to 20. All the relevant documents were reviewed at least 3 times, not just to guarantee that the identified matches correctly fulfilled the principle description, but also to ensure there were no important pieces of information laid aside. When the fulfillment of a certain principle could not be found through the reading, a key word search, according to that particular principle, was made to ensure that there was no additional relevant information missing. Other measures used in the literature that allow to differentiate between the level of ERM implementation hardly could be applied in this specific context: S&P and RIMS do not disclose ERM ratings for companies in the Construction & Engineering industry and I was able to find only one ERM maturity classification system applied to this industry, which, as previously described, cannot be applied in this work. Also, other ERM scores developed in the literature are rooted in specific characteristics - e.g. Florio & Leoni (2017) risk management score is built under the Italian Corporate Governance code recommendations as their sample comprehend companies listed on the Milan Stock Exchange – or are outdated – Gordon et al. (2009) developed an index based on COSO's 2004 Framework defined objectives for ERM. In my opinion, my measure of ERM quality constitutes an important improvement to some of the

past studies that investigated the relation between ERM and firm value, mainly the ones that used a dummy variable to evaluate the effect of ERM, which seems to be too much simplistic to capture the effect of a system that is argued to be complex with many interrelated components. Compared to scores created on other researches (e.g. Gordon et al. (2009) and Florio & Leoni (2017)), this classification has the advantage of considering a variety of characteristics that cover not only the traditional areas of risk management and assessment and corporate governance, but also other important components such as culture or strategy-setting, which makes it more complete and complex. Also, it clearly captures the idea that ERM is supposed to be incorporated and aligned with all the organization and is a step forward in order to create a measure that accounts for ERM level of implementation. Despite that, and similar to what can be found in the literature, this measure has some weaknesses and causes some constraints to this analysis: first of all, as this ERM Framework was released in 2017, it only makes sense to use the *ERMscore* variable from that period on. As the majority of the companies' 2019 financial statements were not released at the time of the data collection, I was only able to collect data for the years 2017 and 2018; COSO does not make any mention regarding the weight of each principle or component in the ERM System. Thus, I attributed the same weight to each principle, which may not correspond to what is verified in reality; despite the *ERMscore* is constructed based on a Framework developed by a world reference entity in risk management and corporate governance guidelines, which gives it some credibility, it does not allow for a degree of differentiation between principles: what is evaluated is if the principle is fulfilled or not and not the extent of the fulfillment. In other words, the score system is based on the existence or not of the principles in the organizations rather than the quality in which they are applied; sometimes, essentially when the disclosure is not explicit, which happened with relative frequency, the attribution of the score was highly dependent of my personal interpretation, which confers a certain degree of

subjectivity to this evaluation when compared to other scores constructed in previous researches; finally, self-reporting is subject to obvious bias.

The set of control variables is composed by a group of controls that, according to the literature, consistently impact the firm value. I proxy for firm size using the natural logarithm of the book value of total assets, consistent with previous researches. To control for the relation between firm value and capital structure, I have included a financial leverage variable (*Leverage*) which is equal to the book value of liabilities over the market value of equity. *SalesGrowth* proxies for growth opportunities and is measured as the historical one-year sales growth. Return-on-assets (*ROA*) is the measure for firm profitability and is measured as the ratio of net income over the book value of total assets. *IndDiv* denotes an indicator variable equal to 1 when a company shows sales in NAICS (NAICS, n.d.) codes in more than 1 industry. Only industries that represented at least 5% of the total revenue were considered to measure the Industry Diversification variable. I have also included two variables related to the companies' Board of Directors: *BoDSize* corresponds to the number of members that are serving on the Board of Directors and *BoDIndependence* corresponds to the percentage of outsiders as board members. Finally, a series of firm and time dummy variables were included, which will be discussed below.

Given the research design and variable's description, the first regression model is derived as follows:

$$\begin{aligned} TobQ_{i,t} = {} & \beta_0 + \beta_1 ERMscore_{i,t} + \beta_2 Size_{i,t} + \beta_3 Leverage_{i,t} + \beta_4 SalesGrowth_{i,t} \\ & + \beta_5 ROA_{i,t} + \beta_6 IndDiv_{i,t} + \beta_7 BoDSize_{i,t} + \beta_8 BoDIndepence_{i,t} \\ & + \beta_9 \Sigma_{i=1}^{13} FirmDummy_i + \beta_{10} \Sigma_{i=1}^{1} TimeDummy_t + \varepsilon_{i,t} \end{aligned}$$

where i represents the company and t the time (years 2017-2018).

For Robustness Check I have also developed two additional models. First, I decided to control for the effect of ERM engagement on ERM. To do that, I have searched for ERM implementation evidence on companies' reports, newswires, announcements and other media. Following the studies of Beasley et al. (2008), Pagach and War (2010), Hoyt and Liebenberg (2011), Bertinetti et al. (2013), Agustina & Baroroh (2016) and Anton (2018), I have performed ERM key related terms and their acronyms search ("enterprise risk management", "strategic risk management", "comprehensive risk management", "consolidated risk management", "holistic risk management", "integrated risk management", "effective risk management", "chief risk officer" and "risk committee", - and detailed hand research for ERM evidence on financial reports. I add the expressions "COSO" and "ISO" to the list of terms used previously in the literature because many companies use their guidelines as a basis for ERM implementation. Each "hit" was reviewed to ensure it was in fact related with the existence or implementation of an ERM system. Despite this method does not capture the extent and complexity of an ERM system and ignores observations in which firms describe common "ERM practices" but do not explicit mention ERM on their reports, it allows to evaluate the market judgement when there is clear evidence of ERM activity. The variables to include in the model are the same, but in this case the ERM variable controls for ERM engagement rather than its level of implementation. The *ERMengagement* is a dummy variable equal to 1 if there is evidence of ERM activity using the methods described above and zero otherwise. Despite it makes sense that after finding ERM evidence in a given year, the following years will continue to record evidence as the ERM system is viewed as continuous process, I did not take it as guaranteed and have controlled for evidence of ERM engagement for all companies in all the years. The second regression of this study is given as follows:

$$TobQ_{i,t} = \beta_0 + \beta_1 ERMengagement_{i,t} + \beta_2 Size_{i,t} + \beta_3 Leverage_{i,t} + \beta_4 SalesGrowth_{i,t} + \beta_5 ROA_{i,t} + \beta_6 IndDiv_{i,t} + \beta_7 BoDSize_{i,t} + \beta_8 BoDIndepence_{i,t} + \beta_9 \Sigma_{i=1}^{13} FirmDummy_i + \beta_{10} \Sigma_{i=1}^{1} TimeDummy_t + \varepsilon_{i,t}$$

where i represents the company and t the time (years 2014-2018).

I have also controlled for the effect of the level of ERM implementation on firm performance. Following Baxter et al. (2013) and Florio & Leoni (2017), I have used ROA to measure historical accounting performance. In this case, the explained variable is ROA and the explanatory variables are the same as in the first regression model. As so, the third regression model is given as follows:

$$ROA_{i,t} = \beta_0 + \beta_1 ERMscore_{i,t} + \beta_2 Size_{i,t} + \beta_3 Leverage_{i,t} + \beta_4 SalesGrowth_{i,t} + \beta_5 IndDiv_{i,t} + \beta_6 BoDSize_{i,t} + \beta_7 BoDIndepence_{i,t} + \beta_8 \Sigma_{i=1}^{13} FirmDummy_i + \beta_9 \Sigma_{i=1}^{1} TimeDummy_t + \varepsilon_{i,t}$$

where i represents the company and t the time (years 2017-2018).

I have collected data for firm value, size, leverage, growth opportunities, profitability, industry diversification, board size and board independence in the period between 2017 and 2018 using the *EIKON: Thomson Reuters* data stream. The data selection is consistent with previous studies. Table 5 summarizes variables' definitions and sources of information as well as their expected impact on the explained variable according to the existent literature.

Table 5 - Variable Definitions, Expected Signs and Sources of Information

Variable name	Expected Sign	Variable Definition	Source
Tobin's Q		Ratio between the sum of the market value of equity plus the book value of liabilities over the book value of assets	*EIKON: Thomson Reuters*
ERMscore	+	Sum of the 20 principles described on COSO's "Enterprise Risk Management – Integrating with Strategy and Performance" Executive Summary (2017)	Companies' Financial Statements, Corporate Governance Reports and websites
ERMengagement	+	Dummy variable equal to 1 if there is evidence of ERM activity using the methods described above and zero otherwise.	Companies' Financial Statements, Corporate Governance Reports and websites
Size	-	Natural logarithm of the book value of total assets (in million EUR)	*EIKON: Thomson Reuters*
Leverage	Ambiguous	Ratio of the book value of liabilities on the market value of equity	*EIKON: Thomson Reuters*
Sales Growth	+	Sales in year$_t$ minus sales in year$_{t-1}$/sales in year$_{t-1}$	*EIKON: Thomson Reuters*
ROA	+	Ratio of net income over the book value of total assets	*EIKON: Thomson Reuters*
Industry Diversification	Ambiguous	Dummy variable equal to 1 if firm is industrially diversified as exhibited by EIKON: Thomson Reuters data stream showing sales in NAICS codes in more than one industry	*EIKON: Thomson Reuters*
Board Size	-	Number of members serving on the Board of Directors	*EIKON: Thomson Reuters*
Board Independence	+	Percentage of Independent Board Members	*EIKON: Thomson Reuters*

Chapter 3

Data and Preliminary Results

3.1 Sample Development

As this research is framed in my internship in the Risk Management and Compliance department at the Mota-Engil Group, it was important to align the main purpose of the study, which is to investigate the relation between ERM and firm value, with the company's interest. So, this analyses was developed in the context in which Mota-Engil operates, shaping a sample with companies that, after the definition of some criteria, can be comparable to it. As so, I have collected data for 14 companies in the Construction & Engineering industry (Mota-Engil included). The starting point for the sample definition was the Engineering News-Record website, which ranks the Top 250 International Contractors (public and private) in a yearly basis according to the construction revenue that is generated outside company's home country (News-Record, 2019). After that, the following criteria was applied: first it was important to focus on publicly traded companies, not just to guarantee access to market measures of company value, but also because publicly traded companies are more likely to disclose information about ERM (Hoyt and Liebenberg, 2011); second, companies with less than 50% of their revenue in Construction & Engineering activities were excluded (consistent with Cox & Ness, 2009) in order to reduce the likelihood of biased results essentially originated by their typical involvement in concession contracts; third, I elected to focus on companies with more specific similar characteristics to Mota-Engil, namely international footprint, both in terms of geographical presence and type of activities developed. The inclusion of all the

companies in the sample was supervised by the Global Head of Risk and Compliance of the Mota-Engil Group. It is important to highlight that the data collection regarding Mota-Engil was not influenced by the fact I was attending an internship program there. That means the data was collected in equal circumstances, applying the same methods and without privileged information about the Mota-Engil Group. The final sample for the first and third regression models comprehends panel data for 14 companies, filtered from the criteria mentioned above, for the years of 2017 and 2018, counting for a total of 28 observations. For the second regression model, as I there was no time restriction imposed by the ERM variable selection, I collected data for the 14 companies, but for the years between 2014 and 2018, counting for a total of 70 observations.

3.2 Descriptive Statistics

Table 6 presents descriptive statistics for the explained and explanatory variables. As it is shown, the median firm in the data has, in the median year, a market value greater than the value of its assets by a ratio of 1.12, presents an ERM score of 17, which means the sample is composed by firms with good levels of ERM implementation, has around 12772 million EUR in total assets, an higher portion of debt compared to its market capitalization by a ratio of 1.67, presents a growth in its sales by 7.7% and a profitability of 2.2% in terms of ROA, is industrially diversified and has a Board of Directors composed by 13 members, which 38.7% are outsiders.

Table 6 - Descriptive Statistics

Variable	Mean	Median	Std. Dev.	Min	Max
TobQ	1.124	1.061	0.208	0.779	1.546
ERMscore	16.857	17.000	1.820	12.000	20.000
Size	9.508	9.455	0.790	8.319	11.230
Leverage	2.171	1.665	2.149	0.380	10.350
SalesGrowth	0.045	0.077	0.137	-0.521	0.227
ROA	0.017	0.022	0.032	-0.117	0.050
IndDiv	0.571	1.000	0.504	0.000	1.000
BoDsize	13.179	12.500	3.878	6.000	21.000
BodIndependence	0.461	0.387	0.209	0.176	1.000

*The statistics presented are computed across 28 observations.

Table 7 presents the ERMscore variable frequency distribution. As it is shown, the sample does not comprise firms with rudimentary ERM levels, which may be a factor to consider during the analyses.

Table 7 - ERM score frequency distribution

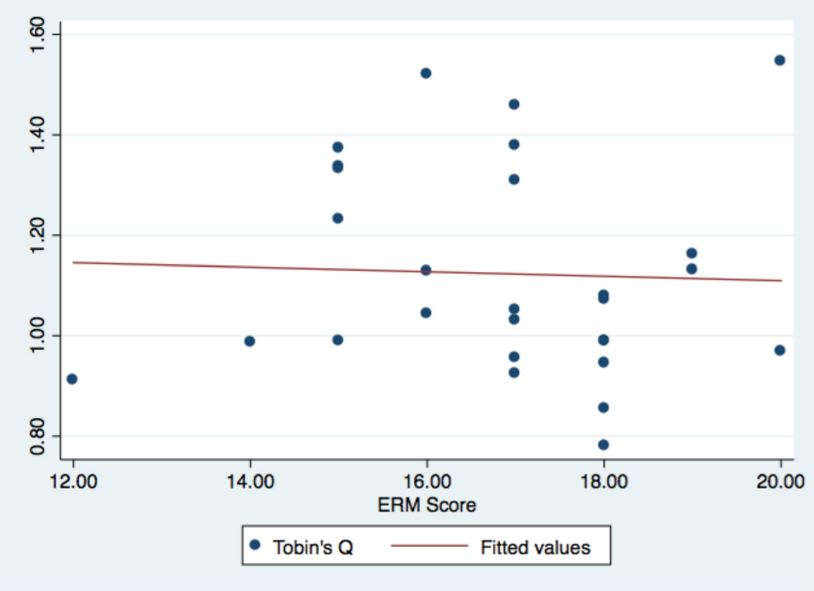
ERM score	Freq.	Percent	Cum.
12	1	3.570	3.570
14	1	3.570	7.140
15	5	17.860	25.000
16	3	10.710	35.710
17	7	25.000	60.710
18	7	25.000	85.710
19	2	7.140	92.860
20	2	7.140	100.000

3.3 Preliminary Analysis

Figure 4 relates the measures of firm value and ERM level of implementation and constitutes a preliminary analysis to the research question as it represents both the original data points and the linear trend of the final data. The data seems to suggest, if any, a slightly negative relationship between firm value and the level of ERM implementation. In a general overview, and despite there are several studies that do not find a relevant effect of ERM on firms (e.g. Pagach and War (2010), Agustina & Baroroh (2016), Anton (2018)), these results contradict my initial expectations. The results find in literature do not generate general consensus but overall it can be argued that there is some evidence supporting the positive impact of ERM implementation on firms. As so, this preliminary analysis may contradict the academic literature that exhaustively argues the value enhancement benefits of ERM on firms as well as previous empirical research on this field. However, we must take into account the sample characteristics. In specific, as it comprises reference firms in Construction & Engineering industry, the market may consider acceptable levels of risk management as an established fact in its judgment. Also my chosen ERM implementation metric determines a sample of firms with a good or high level of ERM implementation (please consult table 7), which implies that these results do not differentiate between firms with simplistic and complex levels of ERM implementation. Considering this information, the preliminary results seem to suggest that the market does not express any sort of differentiation between good levels of ERM implementation. In other words, it may be true that going from TRM to ERM enhances firm value as it argued by ERM proponents, but there is no distinction between different levels of ERM. In fact, this general overview is consistent with the results obtained by McShane et al. (2011), who found a significant and positive association between firm value and risk management as firms implemented

increasingly more sophisticated TRM but did not find further relation as firms achieve ERM. Also, it can be hypothesized that investors, when evaluating construction companies' risk management, give priority to PRM and underestimate ERM. However, no definitive answer to the research question can be made until the addition of the other variables to the model, which are consistently associated to firm value in the literature, as well as the choice of a proper estimation procedure.

Figure 4 - Preliminary analysis of the impact of the level of ERM implementation on firm value



Chapter 4

Estimation Results

4.1 Estimation Procedure

The sample combines different dimensions of variation (firm and year). Consistent with Bertinetti et al. (2013), in order to control for endogeneity issues originated by eventual unobserved and omitted variables that may be correlated with the explanatory variables, I have used a firm and year fixed-effects regression of *ERMscore* on *TobQ* and the set of controls already described. In order to apply this technique, I have introduced a series of firm and year dummy variables that control for the omitted variables that are assumed constant across firms (and years) but may vary with each firm (and year). This set of variables take the value 1 for all the observations belonging to a specific firm and year and 0 otherwise, ensuring that the effect of belonging to a specific firm and/or year is controlled. As the sample is composed by data for 14 firms across 2 years and the constant term remains in the model, the most appropriate method is to include 13 firm dummies and 1 year dummy in order to avoid multicollinearity problems.

4.2 Results

4.2.1 Enterprise risk management and firm value: main results

Next, I present the results of the regressions to further investigate the relation between ERM and firm value. Table 8 reports the results of the firm and year fixed-effects panel model (first regression model) as well as alternative specifications. In specification (i), where *ERMscore* is the only regressor, there is no significant effect of the level of implementation ERM on firm value. In specification (ii) the control variables were added to the model and the ERM level of implementation has still no significance. The specification has an R-Squared of 0.48. Among the control variables, only BoDSize is statistically significant at the 5% level, meaning that when the BoDSize increases by 1 one member, the firm value increases by a ratio of 0.03 as measured by Tobin's Q. The series of dummy variables that control for firm specific characteristics were added in specification (iii), which has an R-Squared of 0.93. This specification shows a negative and significant relation at the 10% level between the *ERMscore* and *TobQ* as an increase of 1 point in the classification system implemented results in a decrease of firm value by a ratio of 0.18. These results may be related to the eventual weakness of my proxy for the ERM level of implementation. The results for two of the control variables are as expected: size is negative and significantly related to firm value at the 5% level – an increase of 1 million EUR in total assets results in a reduction of firm value by a ratio of 0.75 - and profitability has a positive and significant relation to firm value at the 10% level – an increase of 1% in ROA results in an increase of firm value by a ratio of 6.05. Industry diversification is also positive and significantly related to firm value at the 5% level, as industrial diversified firms are valued higher than non-industrial diversified firms by a ratio of 1.01. Specification (iv) is the model chosen to answer the research

question as it corresponds to the regression of *ERMscore* and the set of controls on *TobQ*, with the inclusion of both firm and year fixed-effects. The results show that the effect of the level of ERM implementation on firm value is not statistically significant. Assuming that higher *ERMscore* values represent higher levels of ERM implementation, this is consistent with McShane et al. (2011), who found no significant relation between more sophisticated ERM systems and firm value. Regarding the control variables, only Size and IndDiv show statistically significance. Size has a negative impact on firm value at the 5% level of significance, meaning that an increase of million EUR in the total assets decreases firm value by a ratio of 0.61, consistent with the idea that larger firms tend to have lower market values (Lang and Stulz, 1994, Allayannis & Weston, 2001, Bertinetti et al., 2013 , Florio & Leoni, 2017). IndDiv has a positive and significant impact on *TobQ* at the 10% level of significance, with industrial diversified firms being valued roughly 70% higher than non-industrial diversified firms, which supports the idea that diversification brings benefits for firms with scope economies, larger internal capital markets and risk reduction (Lewellen, 1971 and Teece, 1980).

Overall, these results show no significant relation between the level of ERM implementation and firm value, which means that the market does not perceive the involvement of firms in good levels of ERM implementation as a relevant signal.

Table 8 - Estimation Results of Regressions of the level of ERM implementation on Firm Value

	Specifications			
	OLS		Fixed-Effects	
Variables	**(i)**	**(ii)**	**(iii)**	**(iv)**
ERMscore	-0.004	-0.017	-0.177*	-0.044
	(0.022)	(0.024)	(0.083)	(0.094)
Size		-0.038	-0.750**	-0.611**
		(0.075)	(0.269)	(0.232)
Leverage		-0.041	-0.017	0.084
		(0.026)	(0.060)	(0.059)
SalesGrowth		-0.426	-0.062	0.177
		(0.270)	(0.225)	(0.219)
ROA		2.372	6.050*	4.971
		(1.390)	(3.077)	(2.600)
IndDiv		-0.013	1.011**	0.702*
		(0.110)	(0.395)	(0.359)
BoDSize		0.033**	0.002	-0.046
		(0.016)	(0.046)	(0.044)
BODIndependence		-0.127	-1.429	-1.041
		(0.188)	(0.910)	(0.776)
Firm Dummies	No	No	Yes	Yes
Year Dummies	No	No	No	Yes
R-Squared	0.002	0.480	0.931	0.960
Overall F-Test	0.040	2.200*	4.730**	6.820**

* All specifications include a constant term and are based on 28 observations. Standard-errors in parenthesis. *** denote p-values < 0.01, ** denote p-values < 0.05, and * denote p-values < 0.10. 0.001^{+} denotes a value smaller than 0.001.

Considering the economic theory on ERM, which clearly highlights the value-adding benefits of adopting an integrated risk management approach, a positive and significant relation between the level of ERM implementation and firm value should be expected. However, this results indicate that there is no significant effect of *ERMscore* on firm value as using Tobin's Q as a market measure. Taking into account the sample characteristics, which only comprises firms with good or high levels of ERM implementation, the results provide evidence that the market does not differentiate between higher quality ERM systems. In other words, the market judgment about a company seems to remain unaffected for upper levels of ERM implementation, which can mean that, as long as companies integrate sufficiently good ERM systems, the exact level of the ERM implementation seems to have a residual importance to the market. Looking at the variety of results of previous researches on the relation between ERM quality, extent or implementation and firm value, the results cannot be argued to be surprising. Although, once more the economic theory on ERM is questioned. The results obtained are not in agreement with those reported by Baxter et al. (2013), Farrell and Gallagher (2015) and Florio & Leoni (2017). However, it is important to point out that the samples analyzed by these researchers comprised wider ranges of ERM quality, allowing for a clear differentiation between good and rudimentary ERM systems. Also, the mentioned authors, excluding Baxter et al. (2013), define ERM as a dummy variable that takes the value 1 for the upper levels of their defined scores and 0 otherwise, which means they aggregated all the observations with acceptable/good levels of ERM implementation in one group, do not allowing for differentiation between them. This results of the are similar to those presented by McShane et al. (2011) who pointed out a significant and positive reaction of the market to distinguish between TRM and ERM but did not find any relevant market judgment for upper levels of ERM quality. There are some reasons that can explain the obtained results. The level of ERM implementation of the sample, as determined by a score based on the 20 ERM

components of COSO's 2017 "ERM – Integrating with Strategy and Performance" Framework, shows a group of firms with a good or high extent of their ERM programs. This means the results did not capture a market judgment that differentiates low and high levels of ERM implementation and so the market unaffected reaction is limited to upper levels. The inclusion of firms with lower levels of ERM implementation in the sample would probably give rise to different results both according to the economic theory, as it calls for emergence of going from a traditional approach to risk to a more comprehensive and integrated approach, and previous researches on ERM that allow for a differentiation between sophisticated and rudimentary ERM levels. Besides that, contrary to previous researches, which used scores ranging from 1 to 5, the *ERMscore* ranges from 0 to 20, which may contribute for an harder perception and differentiation between close levels of ERM implementation. Other reason may be related with the firms composing the sample. As previously described, they were chosen under some specific criteria and also because of their similarities with Mota-Engil Group, the company in which I developed my internship. As so, all the companies in the sample constitute good references in the Construction & Engineering industry, which can be particularly important because, as we are analyzing reference companies, the market may see an appropriated and integrated risk management as an established fact instead of a distinctive factor.

4.3 Robustness Check

4.3.1 Engagement on Enterprise risk management and firm value

As some of the causes for no evidence of the impact of the level of ERM implementation on firm value in the first regression model can be related to my measure of ERM and also to the hypothesis that market does not differentiate between good levels of ERM, I decided to control for the effect of ERM engagement to evaluate if the market reaction remained "unaffected".

Table 9 reports the results of the regressions of ERM engagement on firm value – second regression model. The specifications and estimation procedures are the same as the ones used in the first set of tests. Despite some differences, namely in the sign of the ERM variable coefficient, overall these results are similar to the ones obtained previously. There is no significant effect of ERM engagement on firm value as the market does not express any relevant judgement when there is evidence of ERM implementation. Among the control variables, the effect of size on firm value remains positive and significant; leverage has a positive effect on *TobQ,* supporting theories that argue that higher levels of leverage will increase managers discipline and reduce investments in sub optimal projects; ROA also has a positive and significant effect on firm value which is consistent with the literature; contrary to the first model, industry diversification does not have any impact on firm value.

Table 9 - Estimation Results of Regressions of ERM engagement on Firm Value

	Specifications			
	OLS		Fixed-Effects	
Variables	**(i)**	**(ii)**	**(iii)**	**(iv)**
ERMengagement	-0.031	0.055	0.068*	0.045
	(0.056)	(0.046)	(0.040)	(0.041)
Size		-0.005	-0.354***	-0.403***
		(0.033)	(0.094)	(0.086)
Leverage		-0.044***	-0.019	0.036**
		(0.014)	(0.016)	(0.016)
SalesGrowth		-0.271	-0.058	0.008
		(0.169)	(0.111)	(0.102)
ROA		3.237***	2.263***	2.249***
		(0.783)	(0.791)	(0.733)
IndDiv		0.032	0.015	0.037
		(0.056)	(0.105)	(0.101)
BoDSize		0.019**	0.004	-0.001
		(0.007)	(0.014)	(0.0129)
BODIndependence		-0.161	-0.160	-0.167
		(0.100)	(0.180)	(0.161)
Firm Dummies	No	No	Yes	Yes
Year Dummies	No	No	No	Yes
R-Squared	0.004	0.484	0.857	0.900
Overall F-Test	0.300	7.140***	13.690***	17.670***

* All specifications include a constant term and are based on 70 observations. Standard-errors in parenthesis. *** denote p-values < 0.01, ** denote p-values < 0.05, and * denote p-values < 0.10. 0.001^{+} denotes a value smaller than 0.001.

Using a common (and simplistic) metric for searching for ERM evidence previously described in the literature, the results showed no effect of ERM engagement on firm value. These results are in line with the results of Pagach and War (2010), who found no changes in various key firm variables for ERM adopters, Agustina & Baroroh (2016) and partially Anton (2018), who provided evidence that ERM does not affect firm value over periods of economic and financial turbulence. Although, they are dissimilar with the studies conducted by Hoyt and Liebenberg (2011) and Bertinetti et al. (2013), who found that firms with ERM programs are valued higher than firms without implemented ERM programs, and partially with Anton (2018), who found that ERM adoption creates value in the period between 2001 and 2007. If in the first set of tests it could be argued that there was no significant relation because the market could not differentiate between higher levels of ERM implementation, the results found in the second set of tests show the market is not even sensitive to the adoption of ERM. The second set of results corroborate the results obtained in the first set of results, which give more credibility to my measure of ERM implementation. They may be explained by the shortage of capacity from a dummy variable to receive the complexity of an ERM system as there are companies in the sample that describe risk procedures consistent to ERM principles but do not provide a clear existence of an ERM system and, consequently, are not considered as "ERM companies". Also, this absence of effect by ERM on firm value may be due to the specific characteristics of the Construction & Engineering industry. Typically, large companies deal with limited large projects with a considerable weight on their annual revenue, each one with very specific characteristics and a lot of risk inherent to them. I hypothesize that, even though the theory of ERM on the Construction & Engineering industry argue that Project Risk Management and Enterprise Risk Management should be interdependent, from the investor perspective it may be more relevant to evaluate companies' general approach to Project Risk Management instead of assessing if project related risks are being

managed in an integrated way all across the organization. This hypothesis is also valid to explain the results obtained in the first set of tests. Skerci (2013) also argues that, as the information disclosed about ERM is qualitative and needs to be examined one by one, investors may not give it enough attention and prefer quantitative and easier comparable information.

4.3.2 Enterprise Risk Management and firm performance

The absence of relation between ERM and firm value means the market does not perceive a higher level of ERM or the engagement on ERM as a value enhancement factor. Although, it doesn't necessary mean that potential value additive factors provided from aren't present. As there is no significant market reaction both to the level of ERM implementation and ERM engagement, I thought it would be interesting to control for a relation between ERM and firm performance.

Table 10 reports the results of the regressions of the level of ERM implementation on firm accounting performance. The results show evidence that firms with higher levels of ERM implementation report better financial performance as measured by return on assets, which is consistent with the works of Baxter et al. (2013) and Florio & Leoni (2017). *ERMscore* has a significant and positive effect on firm performance at the level of 10% significance, suggesting that an increase of 1 point on the level of ERM implementation increases firm performance by 2.3%. In other words, the better implemented ERM systems are, higher is the firm performance.

Table 10 - Estimation Results of Regressions of the level of ERM implementation on Firm Accounting Performance

	Specifications			
	OLS		**Fixed-Effects**	
Variables	**(i)**	**(ii)**	**(iii)**	**(iv)**
ERMscore	-0.004	-0.005	0.019**	0.023*
	(0.003)	(0.004)	(0.007)	(0.011)
Size		0,015	0.073***	0.075***
		(0.012)	(0.017)	(0.018)
Leverage		-0.001	-0.001+	0.003**
		(0.004)	(0.007)	(0.009)
SalesGrowth		0.055	0.016	0.025
		(0.042)	(0.025)	(0.030)
IndDiv		0.002	-0.090**	-0.098**
		(0.018)	(0.032)	(0.037)
BoDSize		0.002	0.003	0.001
		(0.002)	(0.005)	(0.006)
BODIndependence		0.001+	-0.028	-0.012
		(0.030)	(0.104)	(0.113)
Firm Dummies	No	No	Yes	Yes
Year Dummies	No	No	No	Yes
R-Squared	0.058	0.419	0.957	0.959
Overall F-Test	1.610	2.060*	9.450***	8.630***

* All specifications include a constant term and are based on 28 observations. Standard-errors in parenthesis. *** denote p-values < 0.01, ** denote p-values < 0.05, and * denote p-values < 0.10. 0.001+ denotes a value smaller than 0.001.

The first two sets of tests found no evidence of the benefits of ERM on firm value, both in terms of its level of implementation and evidence of its existence. Despite having used two different measures and still did not find evidence of a positive market reaction, that does not necessary mean that the ERM adoption or level of implementation is not beneficial. Consistent with previous studies, I have conducted a third set of tests to control for the effect of the level of ERM implementation on firm accounting performance as measured by return on assets. I found a positive and significant relation ($p < 0.10$) between the level of ERM implementation and firm performance, which is consistent with Baxter et al. (2013) and Florio & Leoni (2017). The results suggest that higher levels of ERM programs enhance companies' operating performance. It may be hypothesized that contractors with higher levels of ERM implementation reach a higher interconnection between ERM and PRM, which allows them to have a better project risk awareness across all the organization and to efficiently allocate its resources. However, the market does not anticipate better future accounting performances for companies with higher levels of ERM implementation.

Conclusion

This study was conducted in organizational context through a six-month internship in the Risk and Compliance area at the Mota-Engil Group. It investigates whether the level of ERM implementation affects firm value in a sample selection of construction companies, following a relatively recent line of interest on ERM prompted by various financial scandals, stringent legislation regarding risk management and the global financial crises.

This investigation contributes for the research field in many ways: first, it adds knowledge on the study of the value implications of ERM on companies; second, to my best knowledge, it is the first investigation to address this topic in the Construction & Engineering Industry, which is advocated to be a prime candidate to adopt ERM (Durm, 2009); third, it develops a new proxy for measuring the level of ERM implementation, quality or maturity, based on the most recent ERM Framework developed by COSO in 2017. In practical terms it also contributes for the awareness of the Mota-Engil Group about the importance of ERM on its specific context, providing an analysis guided for defined comparable companies.

In terms of economic implications, the results show that the market does not perceive or express any relevant judgement about both the adoption and the level of the ERM system as value additive for companies even though it is associated with better accounting performance. Specifically, they suggest that, from the investor perspective, it is may be more relevant to evaluate companies' general approach to Project Risk Management instead of assessing if project related risks are managed in an integrated way all across the organization. The main results show that there is no evidence of a significant relation between the level of ERM implementation as measured by an ERM score based on the fulfillment of the 20

defined principles of ERM defined by COSO on their "Enterprise Risk Management – Integrating with Strategy and Performance" (2017) and firm value as measured by Tobin's Q. Additional tests show no significant relation between the engagement on ERM and firm value but a significant relation between the level of ERM implementation and accounting performance.

The results cannot be disassociated of the limitations of this study. The research on ERM still lacks on reliable proxies for ERM. The ERMscore variable provides some advantages when compared to alternative measures used in the previous empirical researches, mainly the ones that use simple dummy variables to catch the effect of a system that is argued to be complex, but also when compared to other scores developed as it considers not only risk assessment and corporate governance criteria, but also criteria related to culture, strategy-setting and performance, clearly highlighting the idea that ERM is supposed to be incorporated and aligned with all the organization. Despite that, it offers some constraints to the investigation: it has implications on the sample size since COSO's Framework was only launched in 2017, so it only makes sense to analyze companies' reports from that period on; as COSO does not differentiate between the relative importance of each one of the principles, the way the score is developed considers all the 20 principles to have the same weight on the level of ERM implementation, which may not correspond to the reality and also may be dependent on the specific firm; this method does not t allow for differentiating the extent of implementation of each principle, only if it is fulfilled or not and sometimes the judgement about it is highly subjective as the information may not be completely clear. Other limitations can be appointed regarding the sample composition. The second set of tests suggests that the results may not be influenced by the lack of quality of my ERM variable as the market also did not react to ERM implementation. It can be argued that because the sample comprises reference firms in the industry, the adoption or level of ERM implementation may not be a distinctive factor for investors as they consider

reliable risk management procedures as fait accompli. Also this absence of perception of value prompted by ERM may be due to the specific industry. Specifically, the investors may be more sensitive to issues regarding the PRM process as each project has typically a considerable weight on firms results. This would be consistent with Liu et al. (2013) who stated that PRM has involved ERM very little in the construction industry.

Future research

Many questions remain unanswered. This study opens space for future investigations not only on the ERM general field, but also in its specific application in the Construction & Engineering industry as the results can be interpreted as preliminary and not conclusive. For the general study of the value implications of ERM on companies, I believe that the application of this measure of the level of ERM implementation on other industries and with larger samples would improve the knowledge on company's value perception towards ERM. Also it would be important to understand which of the five components and twenty principles developed by COSO are more important for risk management departments in order to construct more reliable scores accounting for each principle's defined weight. Regarding the Construction & Engineering industry, this investigation can be seen as a starting point. Value additive effects of ERM on firm value were not recognized by the market because the sample comprised reference firms in the industry? Or is it really irrelevant in this specific industry? If so, do investors believe that PRM overlaps ERM? What is the relation established between ERM and PRM in practical terms? What is the source of value of ERM? ERM as described by the academic literature should not be value additive, regardless the context? These are only some questions that still need to

be explained, as there is no completely coherence between what is argued by the economic theory and what is provided by the empirical research.

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Appendix

Table 11 – "Enterprise Risk Management – Integrating with Strategy and Performance" - components, principles and descriptions

Component	Principle Description
Governance & Culture	**1. Exercises Board Risk Oversight -** The board of directors provides oversight of the strategy and carries out governance responsibilities to support management in achieving strategy and business objectives
Governance & Culture	**2. Establishes Operating Structures** - The organization establishes operating structures in the pursuit of strategy and business objectives.
Governance & Culture	**3. Defines Desired Culture** - The organization defines the desired behaviors that characterize the entity's desired culture.
Governance & Culture	**4. Demonstrates Commitment to Core Values** - The organization demonstrates a commitment to the entity's core values.
Governance & Culture	**5. Attracts, Develops, and Retains Capable Individuals -** The organization is committed to building human capital in alignment with the strategy and business objectives.
Strategy & Objective-Setting	**6. Analyzes Business Context -** The organization considers potential effects of business context on risk profile
Strategy & Objective-Setting	**7. Defines Risk Appetite -** The organization defines risk appetite in the context of creating, preserving, and realizing value.
Strategy & Objective-Setting	**8. Evaluates Alternative Strategies -** The organization evaluates alternative strategies and potential impact on risk profile
Strategy & Objective-Setting	**9. Formulates Business Objectives -** The organization considers risk while establishing the business objectives at various levels that align and support strategy.
Performance	**10. Identifies Risk -** The organization identifies risk that impacts the performance of strategy and business objectives.
Performance	**11. Assesses Severity of Risk -** The organization assesses the severity of risk.

Performance	**12. Prioritizes Risks -** The organization prioritizes risks as a basis for selecting responses to risks.
Performance	**13. Implements Risk Responses -** The organization identifies and selects risk responses.
Performance	**14. Develops Portfolio View -** The organization develops and evaluates a portfolio view of risk.
Review & Revision	**15. Assesses Substantial Change -** The organization identifies and assesses changes that may substantially affect strategy and business objectives.
Review & Revision	**16. Reviews Risk and Performance -** The organization reviews entity performance and considers risk.
Review & Revision	**17. Pursues Improvement in Enterprise Risk Management**—The organization pursues improvement of enterprise risk management
Information, Communication & Reporting	**18. Leverages Information Systems**—The organization leverages the entity's information and technology systems to support enterprise risk management.
Information, Communication & Reporting	**19. Communicates Risk Information**—The organization uses communication channels to support enterprise risk management.
Information, Communication & Reporting	**20. Reports on Risk, Culture, and Performance**—The organization reports on risk, culture, and performance at multiple levels and across the entity.